FOOD INSPECTION

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FOOD INSPECTION

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Revised and Enlarged
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PREFACE

Food Inspection was published in 1909. It has since been revised a number of times, and several new editions have been called for in the twenty-five years which have elapsed since it first appeared.

Owing to the rapid increase, during recent years, in legislation designed to improve the quality and wholesomeness of the food supply of the Nation, and to the more exacting conditions imposed at examinations for the Food Inspector's Certificate and similar qualifications, the writer, to whom the preparation of this—the fifth edition—was entrusted, has found it necessary to enlarge the size and scope of the book to meet modern requirements.

A new section has been added on the hygiene of cow-houses and dairies, and the production of "clean" and, what is even more important, "safe" milk. It appears probable that changes of considerable magnitude are likely to take place in the near future in the hygienic control of milk, though what precise form they may take it is not possible at the moment to predict. The Milk Marketing Board are proceeding with their scheme for a register of "accredited" milk producers, and its operations are intended to begin in January, 1935. No doubt also the recommendations of the Committee appointed to inquire into Diseases of Cattle, whose report (Cmd. 4591) appeared after this book was in the printer's hands, may also exert considerable influence on future policy. It is believed, however, that the section on milk, containing as it does the elementary principles of sound practice in the production of clean and safe milk, will be found useful whatever changes may be introduced, by legislation or otherwise, in the control of the milk supply of the country.

The book is a practical guide to the inspection of meat and other

foods. The needs of the student have been constantly kept in view, and it is hoped that it may prove useful to those preparing for the Diploma in Public Health, the Food Inspector's Certificate of the Royal Sanitary Institute, and other examinations in connexion with which a knowledge of food inspection is required. Attempt has been made to arrange the different sections so as to admit of ready reference and to facilitate study.

My sincere thanks are due to Dr. Charles White, the Medical Officer of Health of the Port of London, for the description of caseous lymphadenitis and of the methods adopted in the inspection of imported meat; to Dr. Thomas Orr, D.Sc., the Medical Officer of Health of the Borough of Ealing, for much useful information concerning the hygiene of milk production; and to Sir Weldon Dalrymple-Champneys, Bt., for permission to reproduce part of an address given by him on inspection of pasteurization.

I am especially grateful to Mr. J. D. Allen, the Chief Food Inspector, City of Liverpool Public Health Department, for permission to reproduce his photographs, and for his expert assistance in revising a large part of the text.

I am also indebted to Mr. Charles Hattersley, the Chief Inspector of the Fishmongers Company, for reviewing the chapters on fish; to Mr. Alexander Cameron, Meat Inspector, Lanarkshire, for much useful information and for several of the photographs which illustrate the text; to Mr. De Vine, M.C., F.R.C.V.S., &c., Chief Veterinary Officer, Birmingham; to Mr. H. W. Gill, Chief Sanitary Inspector, Folkestone, for permission to reproduce photographs; to Mr. E. G. Felgate, A.R.I.B.A., Architect, Keighley; and to the Mayor of Chesterfield, for permission to publish the plan of the Chesterfield Abattoir.

I acknowledge with thanks the useful information on the humane handling and slaughter of animals supplied by Mr. J. T. MacLeod, of the North British Lifting and Moving Appliance Company, Glasgow, and the illustrations which he placed at my disposal. I am obliged to the Aluminium Plant and Vessel Co., Ltd., for the illustration of the pasteurizing plant, and to Dr. Seligman for information on the subject of pasteurization; to Accles and Shelvoke, of Birmingham, for the illustration of the Barret-Smith pig trap and of the Cash Captive Bolt Pistol; and to the Temple Cox Development Co., for that of the Temple Cox Patent Killer.

Indebtedness to current literature, from which much useful information has been derived, is gratefully acknowledged.

I desire also to thank H.M. Stationery Office for permission to reproduce various memoranda of the Ministry of Health and quotations, &c., from other official documents.

B. M. MACEWEN.

September, 1934.

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CHAPTER I

The Structure of the Animal Body

Cells—Tissues—Skin—Membranes—Cartilage—Bones—Joints and Articulations

The animal body consists of many distinct parts, such as the heart, liver, lungs, and kidneys, each carrying out its appointed work. Such a distinct part of the body is called an *organ*, and the special work of the organ is spoken of as its function. The functions of digestion, excretion, respiration, &c., are performed by a set of organs, or closely related parts, which form a *system*. Thus the digestive system includes the mouth, gullet, stomach, liver, pancreas, and intestines.

The different parts of the body are composed of various materials called *tissues*. There is, for example, the muscular tissue, the hard compact substance known as bone, and the soft greyish-white matter which forms the brain and nerves, called nervous tissue. Connective tissue is the soft stringy material which binds the skin to the body, and passes between the muscles to ensheathe the bones, as well as to hold together the component parts of every organ. The tissue which forms the outer layer of the skin and lines the passages and cavities leading from the exterior to the interior of the body is called epithelium or epithelial tissue.

It should, however, be understood that an organ is generally composed not of one, but of several tissues. Thus muscular tissue is not confined to the large skeletal muscles, but is also found in the walls of the stomach and intestines, and of every artery large or small. Again, adipose, or fatty tissue, is present in nearly every organ of the body.

When thin sections of the tissues are examined with the aid of the microscope, they are found to consist of a large number of minute bodies called *cells*, which are too small to be seen by the unaided eye. Each tissue of the body is composed of cells of the same kind bound together with more or less intercellular substance;

indeed, the cells may be regarded as the bricks of which all animal tissues are built.

CELLS

Each cell consists of a small mass of a jelly-like substance called *protoplasm*, surrounded by a fine membrane, or capsule. In the centre of the protoplasm is a firm mass called the *nucleus*, without which a cell can neither live long nor reproduce itself by division. Each cell in the animal body is a living unit, or entity, which absorbs nourishment, and excretes, or throws off, unwanted or waste materials.

In most tissues cells become worn out and die, while others are formed to take their place. Thus, while the body as a whole undergoes little change from year to year, the living cells of which it is composed are continually dying and being replaced by others. The most common mode of reproduction in tissue-forming cells is by fission, or division, during which process each cell and each nucleus divides into two. The multiplying, or reproduction, of cells plays an important part in the growth and repair of tissues, in health and disease.

The higher animals are built up of numberless living cells, all of which have arisen by division from a fertilized ovum, but instead of forming separate units they have kept together, the cells being massed into tissues and the tissues into organs, each of which has its special function to perform. The cells which compose the various parts of the animal body differ considerably in size, shape, and minute structure. Those found in one part of the body can thus be differentiated from those found in another.

TISSUES

Epithelial Tissue.—Epithelium is the term applied to the cell tissue which covers not only the outer surface of the body (the outer layer of the skin) and mucous membranes connected with it (such as those of the nose, lungs, intestines, &c.), but also invests the closed cavities of the body, as for example the synovial membranes of joints, the great serous membranes (peritoneum and pleura), the interior of the heart and lungs, the blood-vessels, and the ducts of glands. The different varieties of epithelium are classified according to the shape and arrangement of the cells, or according to the function which the cells perform. Epithelium may consist of one or more

layers of cells, the former being called simple, the latter compound or stratified epithelium.

(*a*) Squamous Epithelium (sometimes termed " pavement " epithelium) is composed of flat scale-like cells arranged like a mosaic. It is found in the outer layer of the skin, and lining the serous membranes, the synovial membranes, the air sacs of the lungs, and the interior of blood-vessels and lymphatics.

(*b*) Columnar Epithelium is composed of cells longer than they are wide, presenting the appearance of columns placed side by side, hence the name " columnar ". The mucous membrane of the alimentary canal and the ducts of glands are lined with this epithelium. Some of these cells produce a slimy material called mucus, which lubricates the surface lined by them.

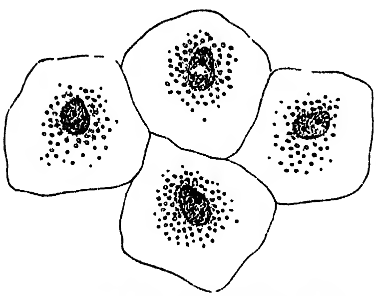


Fig. 1.—Diagram of Squamous Epithelium

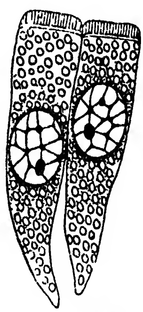


Fig. 2.—Diagram of Columnar Cells

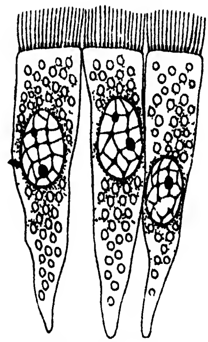


Fig. 3.—Diagram of Ciliated Columnar Cells

(*c*) Ciliated Epithelium.—The mucous lining of the air passages (nose, windpipe and bronchial tubes) as well as portions of the male and female sex organs is formed, on its outer surface, of cylindrical or columnar cells, the free border of the cells being provided with minute hair-like processes called cilia. The cilia are constantly in motion and serve to propel any particles with which they come in contact in one direction, namely, toward the orifice of the cavity in question. The lungs, for example, are protected by the ciliated epithelium of the air passages from fine particles of grit which, entering through the nose or mouth with the inspired air, settle sooner or later on the cilia, and are swept in a steady stream toward the exterior.

(*d*) Glandular Epithelium.—The cells are spherical, cubical, or polygonal in shape. They are the active agents by which various secretions (the product formed by the activity of the glandular cells, such as digestive juices, saliva, &c.) are prepared from the blood which circulates in the neighbouring capillaries.

(*e*) Transitional Epithelium consists of three or four layers of cells

which vary in shape, being often flat on the surface, oval beneath, and round or pear-shaped in the deeper layers. It lines the bladder and urinary tubes.

(*f*) Stratified Epithelium is found in the epidermis (or outer skin), the mucous membrane of the mouth, tongue, throat, and the cornea of the eye. It consists of many layers of cells superimposed on each other. The cells vary in shape, those in the deeper layers (from which growth takes place) being elongated in form, while those above are flat and scale-like. The superficial layers of the epidermis form a horny stratum consisting of cells, many of which have lost their nuclei, and have assumed the form of hard flattened scales. These cells are regularly cast off as scurf and are replaced by those beneath them.

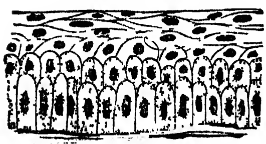


Fig. 4.—Stratified Epithelium

Connective Tissue is found throughout the body. As its name implies, its function is to hold the organs in position, and to bind together the tissues of which each organ is composed. Thus it surrounds and penetrates the muscles, it ensheathes the nerves and blood-vessels, and enters in greater or less degree into the structure of nearly every organ.

Examined under the microscope, the tissue is found to consist of fibres, among which lie a number of cells called connective tissue corpuscles. Two kinds of fibres are described, namely white and yellow, forming white fibrous tissue and yellow elastic tissue respectively. The white are fine, wavy, parallel fibres collected into bundles, which may branch or intercommunicate. The yellow fibres are coarse, straight, and elastic in character, and sometimes branch.

Areolar Tissue is composed of white and elastic fibres forming a meshwork which encloses spaces, or areolæ. The tissue uniting the skin to the underlying parts is a good example of areolar tissue.

White Fibrous Tissue is almost entirely composed of bundles of white fibres, though in some cases elastic fibres may also be present. The spaces between the bundles are occupied by areolar tissue, blood-vessels, and lymphatics. It is a very strong tissue and is found in ligaments (the strong white bands which bind one bone to another) and tendons (the white bands or sinews which connect muscles with bones. It also occurs in serous membranes, and in fasciæ (muscle sheaths).

Yellow Elastic Tissue has a preponderance of yellow elastic fibres in its composition. It is found in those parts of the body in which elasticity is required, such as the coats of blood-vessels, and in the lungs where it assists the respiratory movements.

ADIPOSE TISSUE OR FAT consists of a framework of connective tissue in which ovoid cells are embedded. In these cells oil drops form until nothing remains but a globule of fat surrounded by a thin layer of the cell protoplasm. The fat is fluid during life but quickly solidifies after death.

Fat is found in a layer beneath the skin (subcutaneous fat) and collected round such organs as the heart and kidneys. It is present in the serous membranes (peritoneum and mesentery) and is found in small quantities in the tissues of most organs. It gives roundness to the limbs, forms a good packing material between organs, and being a bad conductor it prevents waste of animal heat. It also provides a store of nourishment for the animal body.

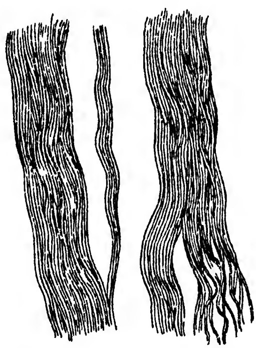


Fig. 5.—White Fibrous Tissue highly magnified

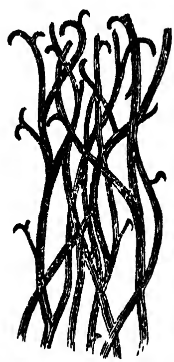


Fig. 6.—Yellow Elastic Tissue highly magnified

In well-fed animals fat is found between the fasciæ of the muscle bundles exhibiting the " marbling " or " veins of fat " which is characteristic of good meat.

Fat varies in consistence, colour and distribution in the different domestic animals; some have white, some yellow fat. In some the fat is firm, in some it is soft, and " sets " badly, while in others it may remain oily after death.

The colour of fat may vary, not only with the species but also with the breed or sex and may be influenced by the feeding of the animal.

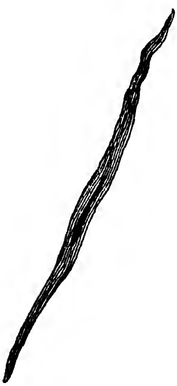
Muscular Tissue.—The red flesh—lean meat or muscular tissue—is made up of bundles of fibres. These are of three kinds:

(*a*) STRIPED OR STRIATED FIBRES (so-called because they have stripes running across the fibres) are found in the muscles attached to the skeleton which produce movement of the limbs, &c. These muscles are known as " voluntary muscles " because they are under the control of the will.

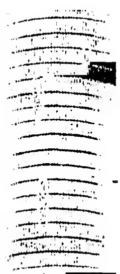
(*b*) Non-striped Fibres are found in "involuntary" muscles. The fibres have no striæ and their contraction is not under control of the will. They occur in the walls of blood-vessels, and in the walls of the organs of the digestive tract, respiratory tract, uterus, &c.

(*c*) Heart Muscle, a form of faintly striped muscle peculiar to the heart wall.

Muscular tissue is distinguished by its power of contracting and is the instrument by which all the movements of the animal body are produced. On close examination a muscle presents a fibrous appearance, and it will be observed that the fibres are arranged with great regularity in the direction in which the muscle contracts. The fibres are surrounded by connective tissue binding them together into bundles which form muscles. Certain other tissues are intimately associated with the muscle fibres, namely fat (which may enclose and penetrate the muscles), blood-vessels (which ramify in their substance), nerves (which connect the muscles with the nervous system and stimulate them to contract), and lymphatics and lymphatic glands. Butcher's meat comprises the above-mentioned structures and is generally sold as joints along with the bones to which the muscles are attached. A description of the characteristics of good meat and of the flesh of the different animals used for food is given on pp. 185, 191 and 193.



Single Muscle Fibre



Striped Muscle

Fig. 7

Nervous Tissue is made up of three substances: nerve cells, nerve fibres, and supporting tissue, known as neuroglia.

(*a*) Nerve Cells vary greatly in size and shape according to their position, but all possess certain characteristics. A typical nerve zell is roughly triangular, with a central nucleus. It possesses two kinds of projections or processes, one, which is longer than the others, called the "neuron", forms the central fibre of the nerve; others, which are short processes radiating outwards from the cell, are known as "dendrites". The neuron acts as the conductor to or from the cell of messages to or from the periphery, while the dendrites serve as the connecting links with other nerve cells.

(*b*) Nerve Fibres are termed white or grey according to the thickness of their sheath or covering. The white fibres possess a firm white sheath, while the grey fibres have merely a thin membrane to protect them. The central fibril of the nerve fibre is formed by the prolongation of the cell neuron, and is known as the "axis-cylinder".

(*c*) The Neuroglia, or supporting tissue, is a fine structure which forms a supporting meshwork between the cell and around the fibres.

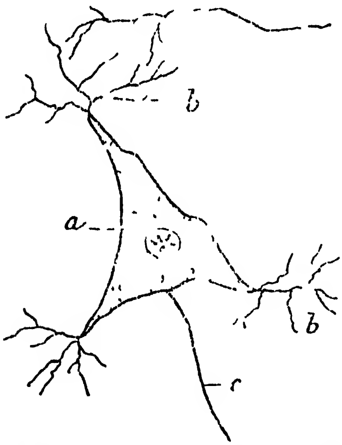


Fig. 8.—*a*. Nerve Cell. *b*. Dendrites. *c*. Neuron

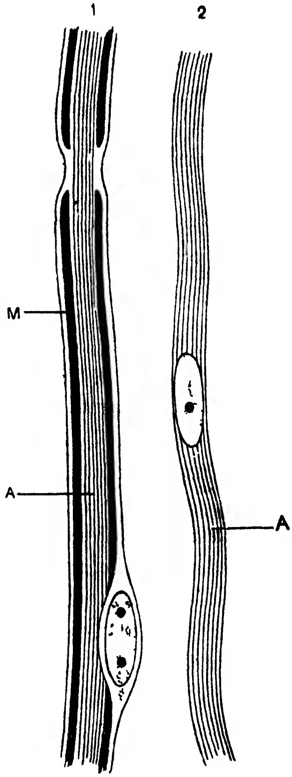


Fig. 9.—Nerve Fibres
1. White Nerve. M. Medullary Sheath. A Axis Cylinder.
2. Grey Nerve with no White Sheath. A. Axis Cylinder.

Nerve tissue is richly supplied with nourishment by the blood-vessels in the membranes which surround every part of the nervous system.

SKIN

The skin has two layers, the outer horny superficial layer called the epidermis, or cuticle, and the deeper layer, or true skin. The outer layer is thicker in some parts than in others, but is composed entirely of epithelial cells. The true skin, on the other hand, consists of connective tissue plentifully supplied with blood-vessels, nerves

and glands. The surface of the skin is covered with the openings of two kinds of glands, sweat glands and oil or sebaceous glands. It has many appendages which are merely specially developed epithelial cells, such as hairs, horns, nails, and hoofs.

The functions of the skin are:

(*a*) To form a protective covering for the body.

(*b*) To act as an excretory organ: sweat is excreted from the sweat glands, and oil from the sebaceous glands.

(*c*) To regulate the temperature of the body by means of evaporation of water from the sweat glands.

MEMBRANES

Serous Membranes are found lining the body cavities; namely, the thoracic, abdominal, and pelvic cavities. The membranes resemble hollow bags, one layer of which is closely attached to the surface of the organ (called the visceral layer), while the other (known as the parietal layer) lines the wall of the cavity. The organs are thus really outside of the bag. In the interior of the sac, between the visceral and parietal portions, is a small quantity of serous fluid (secreted by the cells) which lubricates the membranes, enabling one portion to glide easily over the other, thus preventing friction between the individual organs and between the organs and the cavity wall. The serous membranes in the chest around the lungs are called " pleura "; that in the abdomen is known as " peritoneum ", while a similar bag-like structure surrounding the heart is called the " pericardium ".

Serous membranes are plentifully supplied with blood-vessels and lymphatics. Simple inflammatory conditions of these membranes may produce an increase of the serous fluid, giving rise to pleuritic effusion in the pleura and ascites in the peritoneum, &c. When the inflammation subsides and the superabundant fluid is reabsorbed, it may be found that adhesions have formed between the visceral and parietal portions of the membranes.

Synovial Membranes are very similar to serous membranes, but the lubricating fluid which they secrete is more viscid, resembling the white of an egg. Synovial membranes are found lining the interior of joints, or in the form of small pads or bursæ. They also occur in situations in which free movement is necessary, e.g. in the sheaths of tendons.

Mucous Membrane.—On the lips, in the mouth and nostrils, and at the anus (or vent), the skin becomes modified into a soft membrane, known as the mucous membrane. It forms the lining of the whole alimentary canal (mouth, gullet, stomach, and intestines), the air passages and the genito-urinary tract.

Under the microscope the mucous membrane (like the skin) is found to consist of two layers. The outer layer of epithelial cells is thinner than in the skin, and some of the cells secrete a slimy liquid called mucus, which helps to keep the surface moist.

The epithelium varies in form according to its situation, being squamous in the mouth and throat, columnar in the intestines, and ciliated in the respiratory tract and in the uterus. In the mucous membrane of the alimentary canal are innumerable small glands which secrete the digestive juices. These minute glands appear like pits or depressions, formed by an infolding of the outer layer of epithelial cells. They extend from the surface into the deeper parts of the mucous membrane, where they are surrounded by small blood-vessels which supply nourishment, enabling the glands to manufacture the substance which they secrete.

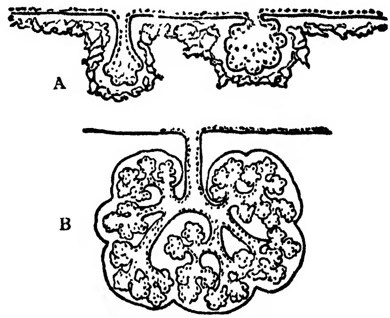


Fig. 10.—Diagram of Gland
A. Simple gland. B. More complicated gland.

CARTILAGE

Gristle, or cartilage, is a tough, flexible tissue found throughout the body in connexion with bones. It is called temporary in parts of the skeleton of young animals where it is later converted into bone and permanent in those parts where it persists until old age, when it becomes hardened by lime salts. The skeleton of a very young animal is almost entirely composed of cartilage, which gradually becomes converted into bone through the deposit of lime salts in the cartilage cells.

Permanent cartilage is found at the ends of long bones (forming articular cartilage), also as discs between the vertebræ, and at the junction of the ribs with the breast bone. Cartilage performs several functions: it helps bones to glide smoothly over one another in

joints; it forms elastic pads between the vertebræ which lessen shock, and in the chest wall it affords greater movement, thus facilitating expansion and contraction during respiration.

BONE

Osseous Tissue, or bone, is the hard tissue which forms the skeleton of the animal.

Bones may be classified according to their shape, namely: (*a*) long bones such as those of the limbs; (*b*) flat, or plate-like bones, such as the shoulder blade and bones of the skull; (*c*) cubital bones, or short irregular bones, as the vertebræ.

Osseous tissue is of two kinds, compact and cancellated. The outer case of all bones is formed of a hard dense ivory-like substance called compact bone; while their interior is composed of a spongy texture called cancellated bone. Long bones have a shaft of compact substance with a small amount of spongy tissue within, but at the expanded ends of the long bones the spongy tissue predominates, being covered with only a thin coating of compact bone. Flat bones consist of two layers of hard tissue with a spongy layer between, while short bones are spongy throughout with only a thin covering of hard substance. The interior of the shaft of long bones is hollow. This affords a combination of strength and lightness. The hollow is filled with bone marrow. Marrow is composed mainly of fat cells, blood cells and blood-vessels.

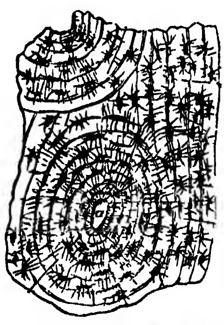


Fig. 11.—Microscopical Appearance of Section of Bone.

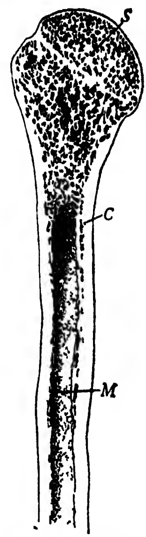


Fig. 12.—Section of Long Bone showing internal structure.
S. Spongy bone.
C. Compact bone.
M. Medullary canal.

All bones are covered externally by a fibrous membrane, called the periosteum, by means of which the bone is nourished. The periosteum adheres closely to every part of the surface except where there is cartilage. In this membrane are fine blood-vessels, nerves and lymphatics, which enter the bone substance through minute holes in its surface, known as Haversian canals. If the periosteum is stripped off, the denuded portion of the bone, being deprived of nourishment, will be liable to die.

Chemical Composition of Bone.—Roughly one-third of bone is made up of animal matter and the remaining two-thirds of chemical matter or salts. The proportions are indicated in the table following:

Animal Matter	$30\frac{1}{2}$	per cent
Phosphate of Lime ..	$57\frac{1}{2}$	,,
Carbonate of Lime ..	7	,,
Fluoride of Calcium ..	3	,,
Phosphate of Magnesium	2	,,
	100	,,

The animal matter is destroyed when bones are burnt, and the chemical salts remain as ash, containing valuable fertilizers (mainly phosphate of lime) which are utilized as manures.

The Skeleton is the bony framework which on the one hand encloses the internal organs, and on the other supports the musculature. A fuller description of the skeleton follows, but in the meantime it may be stated that the bones of the skeleton are bound together by tough fibrous bands, called ligaments, and that the union of two bones with the structures forming the connexion is called a joint or articulation.

ARTICULATIONS OR JOINTS

Joints vary considerably in the degree of motion of which they are capable, from those which are almost immobile to those which exhibit the greatest extent of movement compatible with the maintenance of the bony segments in their proper relation to each other. Joints are sometimes classified as movable and immovable. As examples of immovable joints may be mentioned those of the skull and pelvis. The bones of the former are united by means of irregular saw-like edges known as sutures, which firmly bind them together without the intervention of cartilage.

In all movable joints the surfaces of the ends of the bones which adjoin are lined with smooth articular cartilage, which facilitates ease of movement. The adjoining bones are bound together by ligaments. The whole joint is enveloped in a bag-like structure composed of fibrous tissue, which is firmly attached to the bone above and to that below. This structure is called the capsular ligament, or capsule, and is lined by a serous membrane, known as the synovial membrane, which secretes a viscid fluid called synovia. The fluid

lubricates the cartilaginous ends of the bones and prevents friction.

As examples of different forms of movable joints the undernoted may be mentioned:

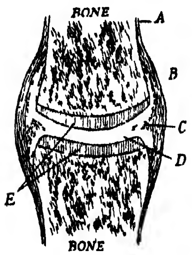


Fig. 12a.

A. Periosteum.
B Capsule.
C Synovial Membrane
D. Joint Cavity.
E. Articular Cartilage

(*a*) Ball and Socket Joints, in which the rounded head of one bone rotates in a socket, e.g. the hip-joint.

(*b*) Hinge Joints which permit of a backward and forward movement in one plane, like a hinge. Certain joints of the limbs form good examples.

(*c*) Joints with Restricted Movements; for example, the joints in the back bone or vertebral column, in which an elastic pad of cartilage lies between each pair of vertebræ, and permits of limited movement only as a result of stretching or compression of the cartilage.

CHAPTER II

The Structure of the Animal Body (*continued*)

The Skeleton—Body Cavities—Muscular System—Chemical Composition of the Body. The following anatomical description relates to the ox; whenever any of its organs or parts differ markedly from those of the other animals which concern the meat inspector, a special description is given.

THE SKELETON

The skeleton consists of a framework composed of all the bones in the body. These are joined together in their natural position by ligaments and joints. The softer tissues of the body are built up upon the framework and the organs are enclosed and protected by it.

The skeleton comprises the following bones:

(*a*) **The Skull and Lower Jaw.**—The skull forms the cranium or brainbox. The upper jaw is attached to the skull, while the lower jaw, or mandible, carrying the lower teeth is a separate bone joined to the skull by means of firm ligaments. The skull articulates with the anterior cervical vertebræ by a ball and socket joint.

(*b*) **The Vertebral Column,** spine, or back bone. The spine consists of many vertebræ which form a long flexible chain extending from the head to the tail. The vertebræ are divided into groups named according to their position:

CERVICAL or neck vertebræ.

DORSAL or those of the back with which the ribs articulate.

LUMBAR, situated in the region of the loin.

SACRAL or vertebræ of the pelvic region. The five bones are fused to form one wedge-shaped bone, known as the sacrum, which articulates on either side with the aitch bones to form the pelvis.

COCCYGEAL or tail vertebræ.

Each vertebra consists of a thick short portion, known as the body, and of an arch, forming a canal in which the spinal cord is situated. Each vertebra has an upward projection known as the spinous process, and two side projections called transverse processes. Between the bodies of

the vertebræ (except in the sacral region) are found elastic cartilaginous pads or intervertebral discs. (See page 12.)

The spinal column of the ox is made up of the following vertebræ:

7 Cervical
13 Dorsal
6 Lumbar
5 Sacral (fused in one bone)
16 to 20 Coccygeal.

The dorsal, lumbar, and sacral vertebræ of the ox are larger than those of the horse. The spinous processes of the lumbar vertebræ of cattle are perpendicular and some distance apart, whereas in the horse they are directed forward, and are in close contact with one another.

(*c*) **The Sternum**, or breast bone, is a long flat bone made up of seven segments jointed together with cartilage. The superior surface is concave and forms part of the floor of the thorax.

(*d*) **The Ribs** are long curved bones which form the sides of the chest wall. They are attached above to the dorsal vertebræ and below to the sternum, or to one another. The ribs which articulate with the breast bone are known as true ribs, while those which fail to reach the sternum articulate with each other and are called false ribs. The latter form an arch known as the costal arch. The ribs are separated one from another by spaces (intercostal spaces) containing muscle tissue (intercostal muscles).

The ox, sheep, and goat have thirteen pairs of ribs, the pig fourteen, and the horse eighteen. The ribs of the ox are longer, straighter, broader and flatter than those of the horse.

(*e*) **The Aitch or Pelvic Bones.**—The innominate or aitch bones, also called shell bones, are two large irregular masses of bone situated one on either side of the sacrum with which they articulate to form the skeleton of the pelvis. They unite below at the " symphysis pubes ". In the fœtus (unborn animal) each innominate bone consists of three portions, the ilium, ischium, and the os pubis; these later fuse into one, and at their point of junction form a cup called the acetabulum in which the head of the femur rotates (the hip-joint).

The Ilium (" hook bone ") articulates with the sacrum, and is a flat bone. In the animal the pelvis tilts forwards and the ilium is the most anterior part of the aitch bone.

The Ischium (" pin bone ") is the most posterior portion and forms the posterior part of the floor of the pelvis. A prominence known as the " tuber ischii " or sciatic tuber, projects from the bone alongside the root of the tail.

The Os Pubis forms the anterior part of the floor of the pelvis. It is a small bone and unites with its fellow of the opposite side at the symphysis pubes.

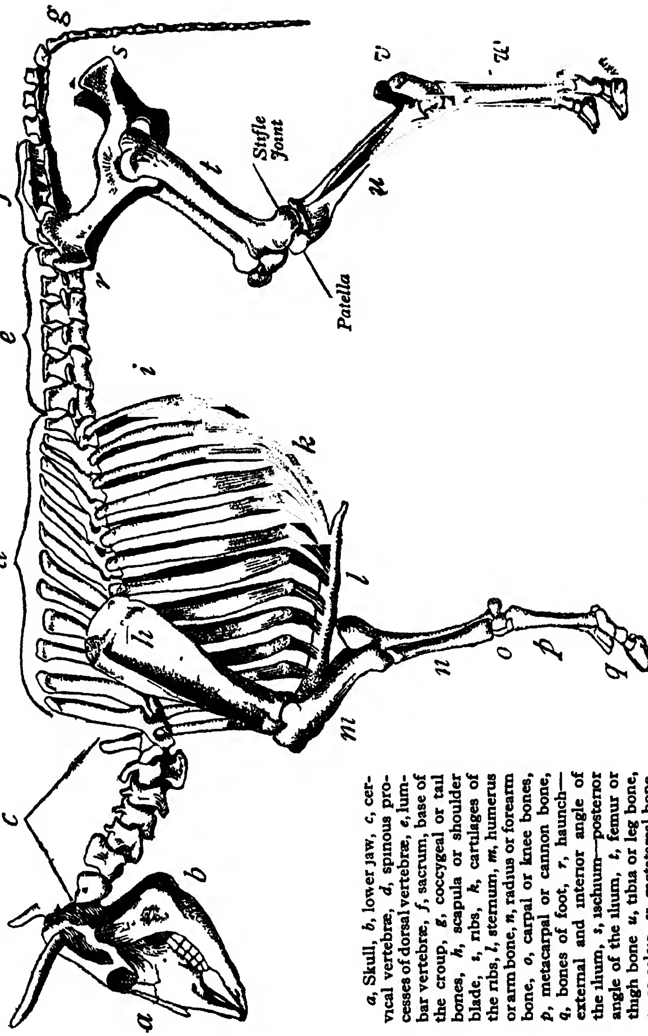


Fig 13 —Skeleton of Ox

a, Skull, *b*, lower jaw, *c*, cervical vertebræ, *d*, spinous processes of dorsal vertebræ, *e*, lumbar vertebræ, *f*, sacrum, base of the croup, *g*, coccygeal or tail bones, *h*, scapula or shoulder blade, *i*, ribs, *k*, cartilages of the ribs, *l*, sternum, *m*, humerus or arm bone, *n*, radius or forearm bone, *o*, carpal or knee bones, *p*, metacarpal or cannon bone, *q*, bones of foot, *r*, haunch—external and interior angle of the ilium, *s*, ischium—posterior angle of the ilium, *t*, femur or thigh bone, *u*, tibia or leg bone, *v*, os calcis, *w*, metatarsal bone

(*f*) Bones of the Fore-limbs.

The Scapula, or shoulder blade, is a flat triangular shaped bone. On its outer surface is a projection or spine (called the scapular ridge) to which muscles are attached. The shoulder joint consists of the articulation between the humerus and the lower angle of the scapula.

The Humerus, or arm bone, is a long cylindrical bone which extends

from the shoulder to the elbow joint, where the humerus articulates with the bones of the fore-limb.

THE RADIUS and ULNA form the bones of the fore-limb. The radius is the larger bone and extends from the elbow to the carpus or knee joint. The ulna in cattle is fused to the radius. Its upper end forms a projection known as the olecranon process or " point of the elbow ".

THE CARPUS, or knee joint, is made up of six separate bones disposed in two rows; the upper articulates with the radius, the lower with the cannon bone.

THE METACARPUS, or cannon bone, is a cylindrical bone which extends from the knee joint to the digits. In the ox there is also a small rudimentary or splint bone.

THE DIGITS, or bones of the foot. In the ox there are two digits separated by a cleft. Each digit is composed of three phalanges; the terminal portion of each main digit is surrounded by a thick covering or hoof upon which the animal walks.

(The Navicular bone is a small bone at the back of the last joint of the terminal digit.)

(*g*) The Bones of the Hind-limb.

THE FEMUR, or thigh bone, is a massive cylindrical bone which extends from the hip-joint above to the stifle joint below. The upper rounded end, or head, fits into the socket, or acetabulum, in the aitch bone. The lower end is expanded and articulates with the leg bones and in front with the knee cap.

THE PATELLA, or knee cap, is a small flat bone roughly triangular in shape, the apex being below. It articulates with the lower end of the femur and is attached to the tibia by means of strong fibrous bands.

The stifle joint corresponds to the knee joint in man, and is formed by the articulation of the femur, patella, tibia, and fibula.

THE TIBIA and FIBULA, or leg bones. The tibia is a long bone extending from the stifle joint to the hock below. The fibula is rudimentary in ruminants.

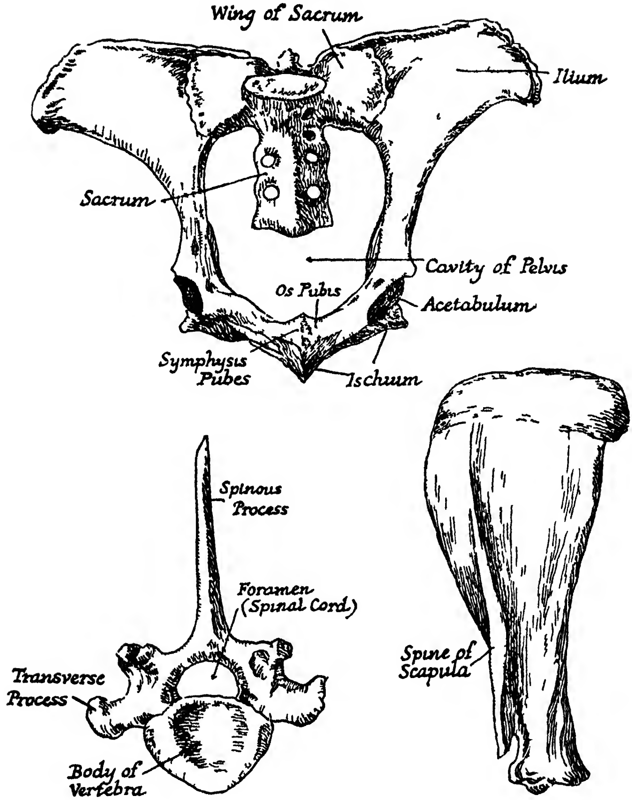
THE TARSUS, or hock, consists, like the carpus, of two rows of bones; the upper contains two segments, one of which—the Os Calcis—has a marked projection known as the " point of the hock ". The lower row comprises three separate bones.

THE METATARSUS is similar to the metacarpus of the fore-limb but is slightly longer.

The digits are almost indistinguishable from those of the fore-limb.

A table setting out the chief skeletal differences in the various animals will be found on page 24.

PELVIS OF OX



VERTEBRA OF OX *LEFT SCAPULA OF OX*

Fig 14

BODY CAVITIES

There are four main body cavities: the cranium, the thorax, the abdomen, and the pelvis.

The Cranium, or brain box, is the cavity formed by the bones of the skull. It contains the brain.

The Thorax, fore cavity or chest, is the anterior body cavity and is formed by the dorsal vertebræ above, the ribs at the sides and the sternum below. It is cone-shaped and is separated from the abdominal cavity by a strong muscular membrane, known as the diaphragm (or " thin skirt "). The thorax contains part of

the upper digestive tube, or œsophagus, part of the windpipe, or trachea, the heart, the lungs, part of the thymus gland (or " sweet bread "), and portions of the great vessels.

The Abdomen, or hind cavity, is unlike the thorax in that it is not completely encased by bone. The lumbar vertebræ form its upper border, while the abdominal muscles form its sides and lower wall. The abdomen contains the stomach, intestines, liver, spleen, pancreas, and kidneys, also the bladder when it is distended. The inner surface of the walls of the abdomen, as well as the principal viscera which it contains, are covered with a smooth glistening serous membrane, the peritoneum. Special folds of the peritoneum serve to hold the stomach and intestines in position by attaching them to the abdominal wall. The former are called the omentum, or " caul fat ", and the latter the mesentery. The mesentery contains many lymphatic glands and in well-fattened animals a great deal of fat.

The Pelvis, or pelvic cavity, is a basin formed by the sacrum above and the aitch bones on either side and below. It contains the rectum or terminal portion of the digestive canal, the bladder, and, in the female, the uterus and ovaries.

THE MUSCULAR SYSTEM

When the skin and subcutaneous fat are removed, the flesh, or skeletal muscles, are exposed to view. The skeleton is covered by layers of muscles, the largest being nearest the surface. Apart from the movements which they cause through contraction of their fibres, they serve to give contour to the body and to protect the deeper structures. The muscles arise by fleshy attachments to the bones of the skeleton and terminate, for the main part, in white tendinous insertions into other parts of the skeleton. They vary in size and thickness according to their position: those of the face are thin and fine, those of the neck are large and strong, those of the abdomen are flat and broad, those of the hip and shoulder are thick and well developed, while those of the limbs are long and slender and have long tendons. The development of the muscles depends upon the extent to which they are used.

CHEMICAL COMPOSITION OF THE ANIMAL BODY

The body is composed of tissues and organs, but in order to facilitate understanding of the functions of its various parts, it is necessary to make brief reference to its chemical composition.

Chemists divide all substances into elements and compounds. An element is a substance which consists of one kind of matter, and which cannot be divided into two or more simpler substances. A compound is a substance formed by the chemical union of two or more elements, which may be split up into these elements. Water, for example, is a compound consisting of two parts of hydrogen and one part of oxygen. By means of electrolysis it can be split up into its component parts, but neither hydrogen nor oxygen can be split up into anything simpler; they are elements.

Elements found in the Animal Body.—Many elements are known to chemists, but only about fifteen have been found in the body. The more important of these are oxygen, nitrogen, hydrogen, carbon, phosphorus, calcium and sulphur. The first three are found both free and in various combinations, while the remainder only occur in compounds. In addition, small quantities of the following may be found in the body, namely, sodium, fluorine, potassium, iron, magnesium, and silicon.

OXYGEN is an invisible gas which forms about one-fifth of the volume of the atmosphere. It is the constituent of the air which supports combustion and is essential for the maintenance of life. It plays a part of supreme importance in the process of respiration, being found free in the air passages of the lungs, and in loose chemical combination with the hæmoglobin contained in the red corpuscles of the blood. Combined with other elements it also occurs in many parts of the body.

NITROGEN is also present in the atmosphere, of which it forms about four-fifths by volume. It occurs free in the air passages of the lungs, and in combination with other elements forms a large number of very important substances in the body.

HYDROGEN is a light, invisible, combustible gas which, in combination with oxygen, forms water. Combined with other elements it is found in many compounds in the body.

CARBON is a solid element which exists in a variety of forms such as black lead and the diamond, the latter being pure crystallized carbon. Charcoal and lamp-black are artificial forms of the element. It does not exist free in the body but occurs in combination with other substances in most animal and vegetable tissues.

Chemical Compounds of the Animal Body.—In chemistry, compounds are sometimes divided into organic and inorganic. Inorganic substances are those derived from the mineral kingdom, such as common salt, limestone, and clay; while organic substances are those produced in

the tissues of plants and animals, for example, sugar, fat, starch, and the white of egg. It was at one time thought that organic compounds could only be produced through the agency of living matters, but in recent years chemists have been successful in producing many organic substances artificially. As organic compounds always contain carbon, organic chemistry is sometimes termed " the chemistry of the carbon compounds ".

Like animals, plants are composed of living cells which are capable of building up living matter from the carbon dioxide of the air and the inorganic substances contained in the soil in which they grow. They not only live on these simple inorganic materials, but convert them into the complex organic substances of which their tissues are composed. Animals, on the other hand, cannot subsist on inorganic substances nor convert them, with the exception of water, into their bodily tissues, hence they are dependent for their nutrition on the materials formed by plants or derived from the tissues of herbiferous animals.

Inorganic Compounds of the Body.—Among the more important inorganic compounds of the body are the following:

WATER (H_2O) is a compound of the two elementary gases—hydrogen and oxygen. It is derived from food and drink, is present in all the tissues and forms about two-thirds of the body weight. It serves to render certain tissues soft and elastic; to dissolve nutrient matter and convey it to all parts of the body in a liquid form, and to assist in such processes as absorption, secretion and excretion.

CARBON DIOXIDE (CO_2), or carbonic acid gas, is continually formed in the body by oxidation of the carbon contained in the tissues. It may be regarded as one of the waste products of metabolism, and its removal is effected in the process of respiration.

SODIUM CHLORIDE ($NaCl$), or common salt, is a compound of sodium with chlorine gas. It is present in the blood and other fluids of the body.

CALCIUM CARBONATE ($CaCO_3$), or carbonate of lime, is composed of the metal calcium with carbon and oxygen. It enters into the composition of bones and teeth.

CALCIUM PHOSPHATE ($Ca_3P_2O_8$), or phosphate of lime, consists of calcium, phosphorus, and oxygen. It forms about 50 per cent of the weight of bone.

Organic Compounds of the Body.—These may be divided into three groups, namely, (*a*) Proteids (nitrogenous); (*b*) Carbohydrates (non-nitrogenous), and (*c*) Fats (non-nitrogenous).

PROTEIDS are complex organic substances containing ammonia. They are composed of carbon, hydrogen, oxygen, nitrogen, and sulphur. Being the only organic compounds in which nitrogen is present, they are called nitrogenous compounds, and form the most important constituents of living cells.

Nitrogenous compounds are mainly composed of certain chemical substances or proteins, the more important of which are:

Albumin—found in blood serum, milk and white of egg.
Globulin—found in blood serum and white of egg.
Myosin—found chiefly in muscle.
Fibrin—found in blood as it coagulates or clots.
Caseinogen—present in milk (the casein of cheese is formed from it).
Gelatin—formed from the chondrin in bone when the latter is boiled.
Chondrin—found in cartilage and bone.

Carbohydrates are organic compounds of carbon, hydrogen, and oxygen, the two latter being in the same proportion as in water. They are generally derived from plants and are used in the animal body as fuel foods. Starch is a typical carbohydrate: it is obtained from potato, wheat, rice, &c.

The more important carbohydrates found in the animal body are glycogen (found in the liver), and grape sugar which exists in blood and other tissues.

Fat consists of carbon, hydrogen, and oxygen, but the proportion of oxygen is smaller than in the carbohydrates. Like the carbohydrates, it forms an efficient fuel food. As fats consist of glycerine combined with various fatty acids, they are technically known as glycerides. Most animal fats consist of olein, stearin, or palmitin, or mixtures of these. Fat enters in greater or less degree into nearly every organ of the body in well-nourished animals.

(*N.B.*—When fat is boiled with an alkali, such as caustic soda, the glycerine is split off and the alkali combines with the fatty acids to form soap.)

Five groups of compounds enter into the composition of the cells and tissues of the animal body, namely, water, mineral salts, proteids, carbohydrates, and fats. While life lasts these substances are continually being consumed within the body, and must therefore be constantly replaced. This is effected by means of the food consumed, which should, therefore, consist essentially of the same five groups of compounds of which the body is composed.

Let us now, for a moment, consider the phenomenon of combustion. By combustion of coal, for example, is meant the chemical process which consists in the combination of the oxygen of the air with the carbon and hydrogen of the coal, which results in the production of heat and light. The products of the combustion are carbon dioxide and water, any incombustible portion of the coal remaining as mineral ash. A very similar process of slow carefully regulated combustion, or oxidation, takes place in the animal tissues, resulting in the production of heat and energy, and in the formation of carbon dioxide, which may be regarded as a waste product. Oxidation of the tissues themselves occurs, but the greater part of the heat and energy generated is derived from the oxidation of such easily oxidized substances as sugar produced from them or obtained

from the food and deposited in the protoplasm for the purpose. In this process the protoplasm is constantly breaking down to be repaired or replaced by new matter. Protoplasm is, however, an extremely complex substance, and the simpler materials of the food have to be combined and recombined in a series of substances of increasing complexity until the living matter itself is formed.

The growth of cells never proceeds beyond a certain point, and when this is reached the process known as division occurs. The cell divides into two halves and each half goes on living as before. It is in this way that the repair of tissues is effected. The higher animals are built up of numberless cells, each having its own life, yet all bound together for mutual service. When food is consumed it is subjected to a process known as

APPENDIX

SKELETAL DIFFERENCES IN THE

Animal	Head	Neck	Vertebræ	Ribs
Horse.	Long, narrow; no horns. Teeth, complete set in upper and lower jaw.	Long and narrow.	Less thick and less broad than those of cattle.	18 pairs; thick, narrow, arched and fixed to the sternum.
Cattle.	Broad, heavy. May have horn cores. Dental pad in upper jaw in place of incisors.	Short and broad.	Large and strong.	13 pairs. Long, thin, broad, straight, jointed to the sternum.
Sheep.	Smaller than in cattle; dental pad present.	Thicker than that of goat.	Rounded back.	13 pairs.
Goat.	Less thick and longer than those of sheep. Dental pad present.	Long and narrow.	Pointed, causing a pointed back.	13 pairs.
Pig.	Broad, complete teeth in both jaws; tusks present.	Short and thick.	Thick and squat.	14 pairs, flat and straight.
Dog.	Long tapering, complete teeth. Typical canines.	Long and slender.	No special characteristic.	13 pairs.
Cat.	Short, broad, snub nose, full teeth.	Short and thick.	Transverse processes of lumbar vertebræ are pointed.	13 pairs, ribs rounded.
Rabbit.	Longer than that of cat. Two incisors close together in the centre of each jaw.	Thin.	The lateral processes of the lumbar vertebræ are bifid.	12 pairs.

digestion before it can be used as fuel or to repair the tissues. The digested food is absorbed into the blood and carried to the liver, which stores the sugar in its cells and gives it out as the other tissues require, muscular tissue being the great consumer of sugar. Animal life cannot be supported in the absence of oxygen, which is required for the process of oxidation carried on in the tissues. Oxygen is held in the blood by means of a special substance called hæmoglobin (contained in the red cells), which greedily absorbs it from the air in the lungs, and yet readily parts with it to the protoplasm of the tissues. The blood, pumped by the heart, constantly circulates through the body, and its fluid portion, or plasma, oozes through the thin-walled blood-vessels, called capillaries, and bathes the surrounding tissues in a stream of food material. The process of oxidation is, however,

A

VARIOUS DOMESTIC ANIMALS

Sternum	Long Bones	Pelvis	Tail
Keel shaped.	Long, strong spine on outer side of Femur and Tibia. Fibula long. Ulna ½ way along Radius.	Broad and short.	17 to 19 segments, thick (often docked).
Flat and broad.	Short, stout, white. Fibula represented by a small end only. Ulna large.	Long and narrow.	18 to 20 segments, thinner than those of horse and not cut.
Lower sternum flat; chest barrel-shaped.	Shorter and thicker than those of the goat.	Compressed	10 to 24 segments, generally docked.
Lower sternum concave; chest flattened sides.	Long and slender.	Long and narrow.	10 to 12 segments, thin and not cut.
—	Rather slender, Femur especially. Short forearm bones.	Very long.	20 to 22 segments, thin and not cut.
—	Femur long and strong.	Short.	20 segments, long and thin but often docked.
—	Tibia short, Radius and Ulna separate. Digits end in claws.	Small.	About 20 segments, thicker than that of dog. Not cut.
—	Tibia long. The Radius and Ulna are fused.	Strong.	A small stump only.

accompanied by the production of waste material which must be eliminated. The lymphatic system may be regarded as a drain into which is thrown the waste products of cell activity. Surplus water may be sweated out of the system by the glands of the skin, or filtered out of the blood by the kidneys and discharged in the urine. Some waste products are prepared for excretion by the liver or may be removed from the blood by that organ and poured into the intestine mixed with other matters, dissolved in a fluid called bile; while others are removed from the blood along with water by the kidneys and voided from the body as urine.

Life may therefore be regarded as a constant process of waste and renewal which goes on until death occurs when the body decays. Decay is really a very slow process of oxidation, during which the complex compounds of the tissues are broken up for the most part into water, carbon dioxide, and ammonia gas, an incombustible residue of mineral ash being finally left behind.

CHAPTER III

Digestive and Excretory Systems

Digestive System: Mouth—Tongue—Teeth—Pharynx—Œsophagus —Stomach—Feeding—Rumination—Digestion in the Stomach —Intestines.
Digestive Glands: Liver—Pancreas—Intestinal Digestion.
Urinary System: Kidneys — Bladder — Urethra — Excretion and Absorption.

Reference was made in a previous chapter to the continued breaking down of tissues that occurs during life, and to the necessity for their renewal. The living body is sometimes described as a "self-repairing machine" which replaces, by its own action, the wear and tear of its substance. This, as we have seen, is effected through the agency of the food consumed. Food may be defined as anything which, when taken into the body, is capable of repairing its waste, or of furnishing it with material from which it produces heat and energy. Before the food can be absorbed and converted into tissue elements and energy, it must first undergo a series of mechanical and chemical changes in the alimentary canal, known as digestion. When digested, the absorbable constituents pass into the blood-vessels and lymphatics in the wall of the intestine and are carried to all parts of the body, while those incapable of becoming absorbed are passed out of the intestine as waste.

The ox, sheep, and goat are herbivorous, or grass-eating, animals, while the pig is omnivorous and can digest food of animal as well as of vegetable origin. The following description of the digestive system relates to that of the ox.

DIGESTIVE SYSTEM

The digestive system consists of a tube of varying diameter which passes through the whole animal trunk from the mouth to the vent, or anus, and of glands (salivary glands, liver, and pancreas) which pour their secretions into the tube at certain parts of its course.

The digestive tube is generally known as the alimentary canal, and comprises the following parts, namely, (1) mouth, (2) gullet, (3) stomach, (4) small intestine, (5) large intestine.

The Mouth is an elongated passage between the upper and lower jaws. It contains the tongue and teeth, and opens behind into the pharynx, or back of the throat, which in turn opens into both the windpipe and the gullet. The mouth is bounded in front by the lips and at the sides by the cheeks. The roof is formed in front by the hard palate, and at the rear by the soft palate. The former is firm and furnished with transverse ridges, while the latter is a muscular sheet which extends from the hard palate to form a curtain, or flap, between the mouth and the pharynx.

The Teeth.—A knowledge of the teeth is important, as they may be employed as a means of estimating the age of the animal.

Each tooth consists of a visible part, called the crown; a neck or constricted portion, which is embedded in the gum; and roots, which fit into sockets in the jaw bone. Teeth are mainly composed of a hard substance called dentine, or ivory. They vary in size and shape according to their function: those in the front of the jaw are chisel-like and sharp, as they are used for biting and cutting, while those at the sides are broader and ridged and are used for grinding the food. The teeth are arranged in two sets—one in the upper and another in the lower jaw. An animal has two dentitions—the first or "temporary" set of milk teeth, smaller and whiter, which are replaced by "permanent" teeth at a definite age, which varies slightly with each species of animal. Three of the molar teeth on each side of the upper and lower jaw are permanent from the start and are not preceded by temporary teeth. An approximate idea of the age of an animal can be gauged by the stage of eruption and condition of wear of the teeth.

The adult ox has eight incisors, situated in front of the lower jaw; the front part of the upper jaw is devoid of teeth, but is provided with a dense fibrous pad. In the posterior part of both jaws molar teeth are found (twelve on the upper and twelve on the lower).

Bovine animals under one year still possess their milk incisor teeth, which are comparatively small (considerably smaller than the permanent teeth), of a porcelain white colour, and narrower near to the gum than beyond. They are eight in number, four on each side, and are named from the middle outwards—central, middle, lateral, and corner.

These milk teeth are cast and replaced by permanent teeth, the

process commencing in the centre and working outwards, thus: At 1½ years the central milk incisors are cast. The central permanent incisors appear at the same period and attain their full

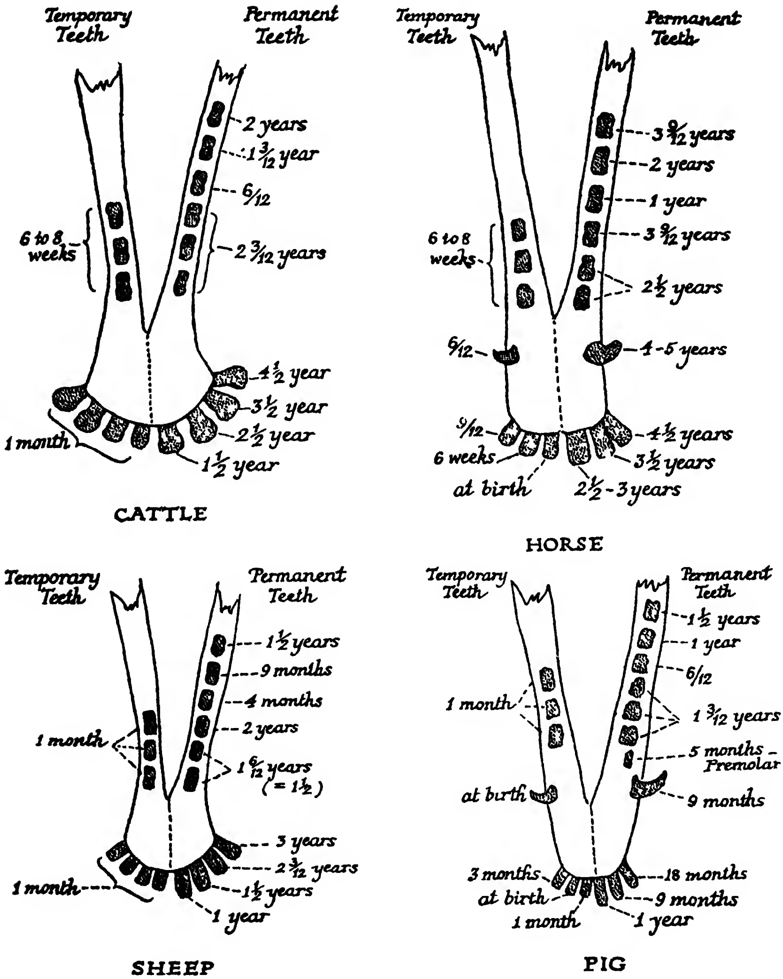


Fig. 15.—In the above diagram the temporary teeth are shown on one side of the jaw, and the permanent on the other. The teeth present in the jaw at different ages are indicated

development at the age of 2 years. At 2½ years the middle milk incisors fall out. The corresponding permanent teeth appear at the same period and attain their full height at the end of the third year. At 3½ years the laterals are changed, the corresponding per-

manent teeth coming into wear during the fourth year. At 4½ years the corner teeth undergo a like change, the permanent teeth coming into wear at the end of the fifth year. At 6 years of age, therefore, the incisor teeth of oxen have attained their fullest development. After this a gradual retrograde process commences, marked by the appearance of a neck.

The following table shows the age at which the milk teeth appear, the age at which they are replaced by permanent teeth, and the age when a neck in the permanent teeth becomes noticeable:

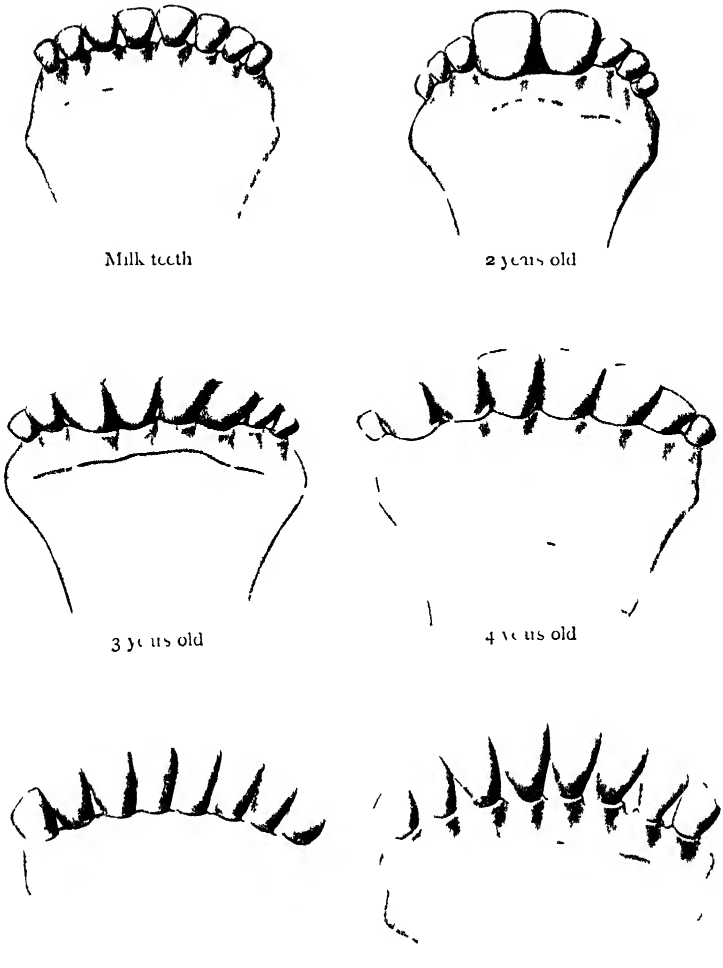
	Milk Teeth Appear	Replacement	Appearance of Neck
Central ..	At birth	1½–2 years	6 years
Middle ..	"	2½–3 "	7 "
Lateral ..	12–14 days	3½–4 "	8 "
Corner ..	3–4 weeks	4½–5 "	9 "

In animals of ten years or more the teeth appear much worn, project far out from the gums, and are separated from one another.

Horse.—Apart from the grinders, a horse has 12 incisor teeth —6 in the upper and 6 in the lower jaw—named, from the middle outwards, central or pincer, lateral, and corner. In addition to these, 4 canine teeth, called "tushes or tusks", generally make their appearance in male animals; in mares these tushes or tusks are absent. The foal incisors have a very similar appearance to the milk teeth of calves. There is a furrow or groove on the cutting surface of the permanent incisor teeth of horses known as the "mark", which is black in colour. As the teeth become worn this "mark" gradually disappears, affording thereby an indication as to the age of the animal.

The following table may serve as a guide to the determination of the age of a horse by an inspection of its teeth:

	Milk Teeth Appear	Replacement	Wearing out of "Mark"
Incisors—			
Centrals or pincers ..	Before or soon after birth	2–3 years	6 years
Laterals ..	4–6 weeks	3–4 "	7 "
Corners ..	6–9 months	4–5 "	8 "
Canines—			
Tushes ..	6 months	4–5 "	—



DENTITION OF OX

Sheep.—A sheep has 4 pairs of incisor teeth on the lower jaw. They appear and are replaced as follows:

	Milk Teeth Appear	Replacement
Central	4–7 days	1 year
Middle	4–7 ,,	1½ years
Lateral	7–10 ,,	2 years 3 months
Corner	3–4 weeks	3 years

The permanent teeth are larger and broader than the milk teeth, and can thus be distinguished from them. After six the incisors become notched; but the condition of a sheep's teeth depends much upon the nature of the pasture on which it is fed. They become worn away much quicker on some than on others.

Pig.—A pig has 3 pairs of incisor and a pair of canine teeth called " tusks " on its lower jaw. They appear and are replaced in the following order:

	Milk Teeth Appear	Replacement
Lateral incisors and tusks	At birth	9 months
Central	1 month	12 ,,
Corner	3 months	18 ,,

The Tongue is a thick muscular organ, lying in the mouth with its free, more or less pointed end towards the teeth, and its fixed base in the back of the mouth. It is covered by a thick mucous membrane, which is more or less rough according to the number and type of the projections from its surface, known as " papillæ ". The papillæ are of two main kinds—filiform, pointed and horny; and circumvallate, mushroom-shaped with a central depression.

The ox tongue is a thick firm organ with a pointed tip; its base is rough from the prominent filiform papillæ which are directed backwards. A row of at least six circumvallate papillæ occurs on either side of the tongue near its base. The ox tongue is frequently spotted with black.

The tongues of the domestic animals vary considerably in size, shape, and other characteristics; the main differences appear in a table at the end of this chapter.

Salivary Glands.—There are three pairs of glands which secrete saliva and pour their secretion into the mouth, namely, the submaxillary, behind and near the angle of the jaw; the parotids, on the side of the head in front of the ear; and the sublinguals, under the mucous membrane on the sides of the tongue. Reference will be made to these glands later.

The Pharynx is a short tubular passage in the throat in direct communication with the mouth. It is common to both the respiratory and alimentary tracts. Food passes through it to reach the œsophagus and air to reach the trachea. The opening from the pharynx into the œsophagus is placed above and behind the opening into the larynx, the latter being guarded by a valve-like structure, called the epiglottis, which closes during swallowing, thus preventing any solid or liquid matter from entering the trachea.

The Œsophagus, or gullet, is a tube-like structure extending from the pharynx to the stomach. It first passes down the neck (above the trachea), then through the thorax in the mediastinum (above the heart), and finally pierces the diaphragm to enter the rumen, or paunch.

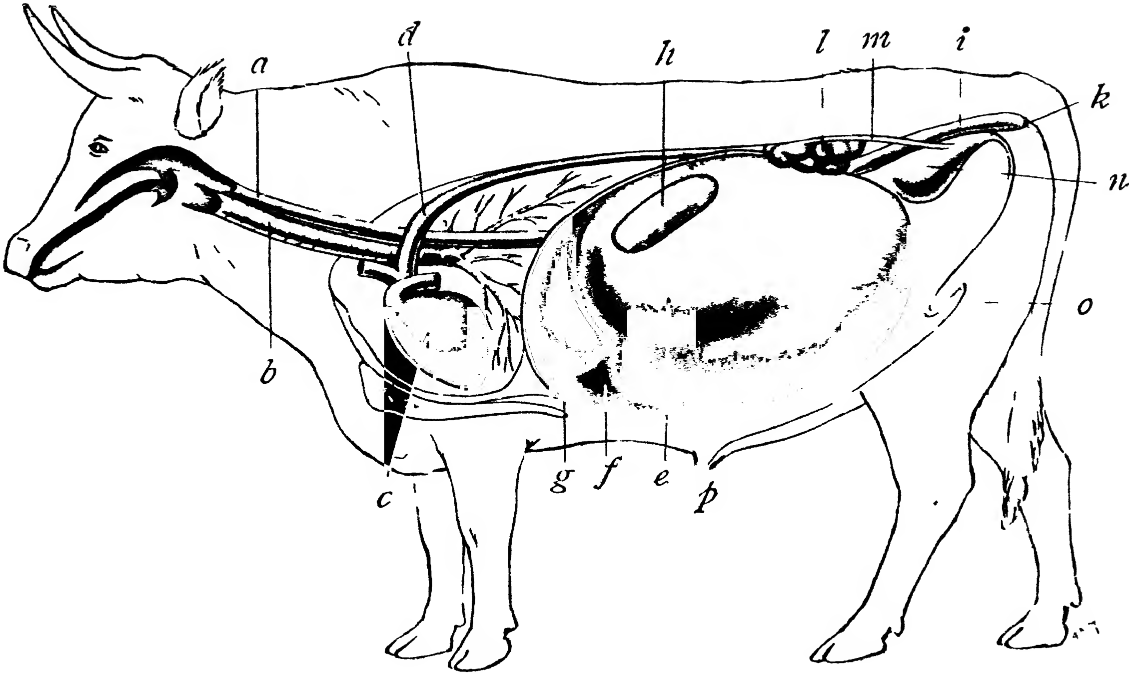
In the act of swallowing, the ball of food is pushed back by the tongue and soft palate, and passing through the pharynx enters the œsophagus, which contracting, from above downwards, propels the food into the stomach.

The Stomach is the main organ of digestion in which the food is retained until sufficiently digested to be passed on into the intestine. It is a sac-like structure, the walls of which consist of four layers —a peritoneal covering externally, a strong muscular coat, a submucous coat composed of connective tissue, and a thick mucous membrane lining the interior. The peritoneal surface is smooth and glistening, and the folds of peritoneum which hold the stomach in position are broad and strong. The muscular coat consists of unstriated (involuntary) muscle arranged in a circular, longitudinal, and oblique direction, which, when brought into action, produces a churning movement of the contents of the organ.

The abdominal cavity in the ox is large and the stomach occupies the greater part of it, filling practically the whole left side and a considerable portion of the right also (Plates II and III).

The stomach of ruminants (ox, sheep, and goat, &c.) is a complex structure consisting of four compartments:

(*a*) rumen, paunch, or first stomach; (*b*) reticulum, honeycomb, or second stomach; (*c*) omasum, manyplies, psalterium,



INTERNAL ORGANS OF OX (left side)

a, Œsophagus *b*, Trachea *c*, Heart *d*, Posterior aorta *e*, Rumen or paunch (first stomach) *f*, Abomasum (4th stomach) *g*, Reticulum (2nd stomach) *h*, Spleen *i*, Rectum *k*, Anus *l*, Left kidney *m*, Left ureter *n*, Urinary bladder *o*, Urethra *p*, Sheath

or third stomach; (*d*) abomasum, rennet bag, or fourth stomach, the true stomach.

THE RUMEN is the largest compartment of the stomach, having a capacity of some thirty gallons. It is divided by a fissure into a right and left lobe and is subdivided by muscular pillars into sacs. It occupies about three-quarters of the abdominal cavity and is situated on the left side in contact with the abdominal wall. The reticulum is in front of the rumen, the omasum and abomasum to its right, while the spleen is attached to its left side. (See Plates II and III.)

THE RETICULUM is the smallest of the stomach compartments. It lies in front of the left side of the rumen and between it and the diaphragm. It communicates with the œsophagus, rumen, and omasum, the communication with the rumen being very free, while the opening into the omasum is relatively small.

THE OMASUM lies on the right side of the animal, behind the liver. It is oval in shape and of firm consistence owing to its strong muscular walls and the horny papillæ on the folds of its mucous membrane.

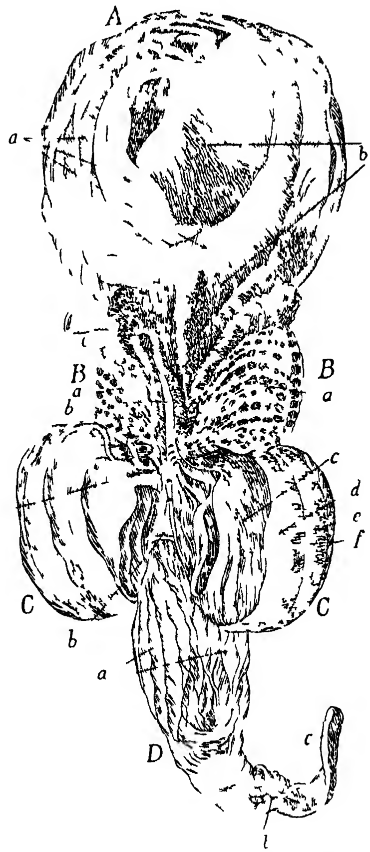


Fig 16—Compartments of a Ruminant Stomach laid open

A, Rumen—*a*, *a* *a*, *a*, pillars, *b*, *b*, papillæ, *c* œsophageal orifice B, Reticulum—*a*, *a*, alveoli, *b*, œsophageal canal C, Psalterium—*a*, hooked papillæ, *b*, valve at orifice leading to abomasum *c*, *d*, *e*, *f*, leaves graduated from small to large D, Abomasum—*a*, *a*, folds of mucous membrane, *b*, pyloric orifice, *c*, duodenum.

THE ABOMASUM is the second largest compartment of the stomach. It is a pear-shaped sac, situated on the right side of the abdomen, with the base directed downwards and forwards, while its narrow posterior, pyloric extremity turns upwards to join the duodenum (or first part of the small intestine).

Mucous Membrane of the Stomach.—The mucous coats of the four compartments of the stomach vary greatly in character and arrangement:

The rumen is lined with rough papillated mucous membrane.

The reticulum has a honeycomb-like mucous membrane, arranged in ridges which run in all directions, leaving recesses like those of a honeycomb.

The mucous membrane of the omasum is arranged in the form of a large number of leaves, whose surfaces are covered with horny projections or papillæ. The leaves are suspended from the upper part of the organ, and hang free into its cavity.

The abomasum is lined with a fine velvet-like mucous membrane which in its upper part is thrown into many longitudinal folds. This membrane contains glands which secrete the digestive juices.

FEEDING AND RUMINATION

When an animal feeds, the fodder is first subjected to superficial mastication, or chewing, whereby it is saturated with saliva from the salivary glands. It is then swallowed, passing down the œsophagus into the rumen, where it is subjected to a churning process produced by the contraction and relaxation of the strong muscular walls. Thus the food becomes broken up and thoroughly mixed with warm alkaline saliva, and fermentation is induced by the action of the cellulose-splitting and other forms of bacteria.

When feeding is completed and the food has remained sufficiently long in the rumen for maceration to have taken place, rumination, or chewing of the cud, commences.

Rumination.—In this process small balls of food are regurgitated from the rumen into the mouth. By muscular action of the walls of the stomach, a ball of food is thrust into the relaxed œsophagus which then commences to contract from below upwards, thus propelling the bolus into the mouth, where it is subjected to thorough mastication by the strong molar teeth aided by the lateral movements of the lower jaw. During this process it is thoroughly mixed with saliva containing a ferment, called ptyalin, which has the power of converting the starch of the food into sugar. When reswallowed, the food generally passes from the gullet into the omasum, or, if not in a fit condition, it is returned into the rumen. Indeed, the consistence of the swallowed food determines into which compartment it will pass. The walls of the stomach, near the entrance of the gullet, are thrown into two folds forming a deep groove bounded by two prominent lips. This is known as the œsophageal groove; it extends from the œsophageal opening of the rumen downwards and to

the right along the roof of the reticulum to open into the omasum. Through this tube fluids and finely divided matter can pass into the omasum, while freshly swallowed grass, or coarser materials, pass between its lips into the rumen.

The function of the reticulum is to regulate the passage of fluid through the stomach. It receives the overflow from the rumen which may either pass on into the omasum or back into the rumen as circumstances require.

The food, on entering the orifice on the floor of the omasum, is pressed upwards in thin layers between the horny papillæ of the leaves and is ground into fine pieces. When the grinding process is completed the fluid and finely divided food pass into the abomasum or true stomach.

The mucous membrane of the abomasum, or rennet bag, is richly supplied with glands which secrete the gastric juices, and it is in this compartment that true digestion takes place. The gastric juice contains two ferments—pepsin and rennin, and a certain amount of hydrochloric acid. Pepsin converts the proteids or albuminous matter contained in the food into peptones. These pass readily through the membranes into the circulation. Rennin aids in breaking up the proteids, but the presence of an acid is necessary for " peptic digestion ", hence the presence of the hydrochloric acid. Through the action of these agents, the capsules containing the fat globules in the connective tissue are dissolved and the fat is set free. The food thus acted upon forms a milky-looking fluid called chyme, which passes from the abomasum into the intestine.

It should be noted that the glands in the stomachs of herbivoræ, or grass-eating animals, secrete no juice capable of digesting the cellulose which forms a large part of their diet. The stomach and intestines of such animals, however, contain large numbers of cellulose-splitting bacteria which convert the fibres into sugars and other substances of considerable nutritive value.

The stomachs of sheep and goats are similar to the ox stomach, but are smaller in size. The stomachs of non-ruminants consist of simple sacs, that of the horse being small in proportion to the size of the animal. When distended it appears as a curved tube, constricted in the centre, with a dilation on either side—that on the left being known as the cardiac and that on the right as the pyloric portion; the former is much larger than the latter.

(It may here be mentioned that the colon and cæcum of the horse are very large and appear to take the place of the rumen in the ox.)

The pig's stomach is larger in proportion to its size than that of the horse. It consists likewise of two divisions—cardiac and pyloric. A small diverticulum, or cul-de-sac, present at the upper and left portion of the cardiac half, is characteristic of the stomach of swine, and distinguishes it from that of other animals. The stomach of the dog is but slightly curved, and is commonly described as pear-shaped.

Tripe is obtained from the stomach of the ox; rennet (for making

junket) is made from the calf stomach, and pepsin is largely manufactured from the stomach of the pig.

THE INTESTINES

The intestine is a long tube-like structure which commences at the pylorus of the stomach and ends at the anus. It is divided into two parts; the first portion is known as the small and the second as the large intestine.

The Small Intestine.—The tube forming the small intestine is continuous with the pyloric end of the stomach. At the site of their junction is a valve-like structure, the pylorus, which prevents regurgitation of the intestinal contents into the stomach. The small intestine is divided into three portions:

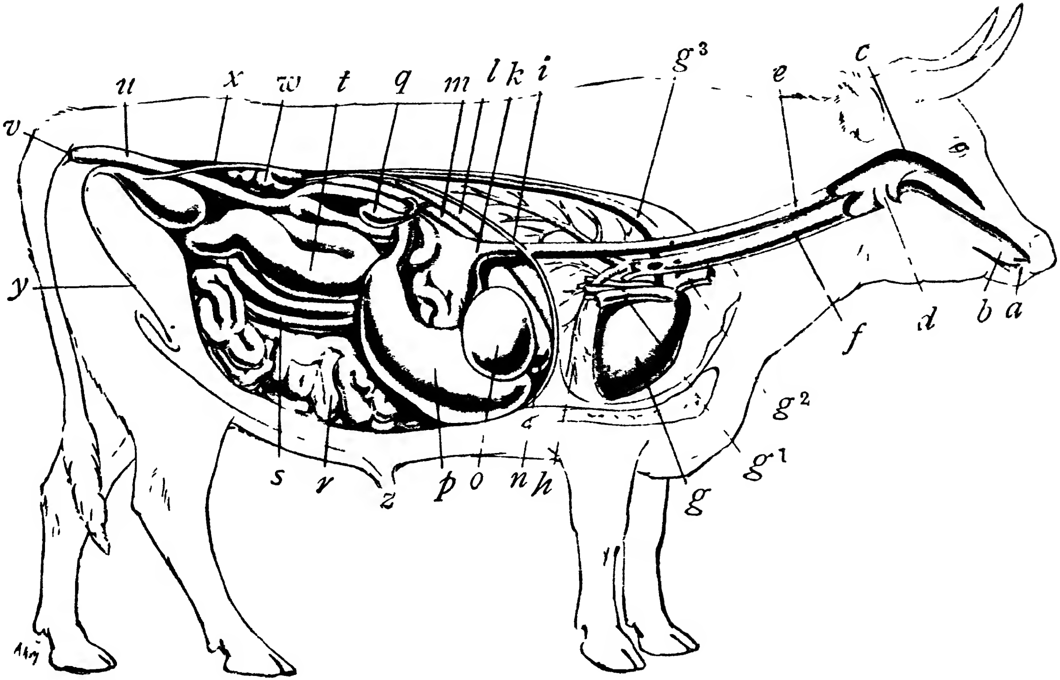
(*a*) THE DUODENUM, or first part, is about three to four feet long in the ox, and is more or less S-shaped. Into this portion of the gut two ducts open—the one from the pancreas, the pancreatic duct; the other from the liver, the bile duct.

(*b*) THE JEJUNUM, or second part.

(*c*) THE ILEUM, or terminal portion, which ends at the ileo-cœcal valve. This valve, situated at the junction between the small and large intestine, prevents regurgitation of food from the latter into the former.

The total length of the small intestine of the ox is about 140 feet and it is about 2 inches in diameter; that of the sheep is about 80 feet long; that of the pig 56 feet; while the horse has a small intestine of about 70 feet in length with a diameter of 3 or 4 inches. The small intestine is supported by the mesentery from the roof of the abdomen, and hangs in many folds forming convolutions. Between the layers of the mesentery near the upper edge of the gut are placed the mesenteric glands.

The structure of the small intestine resembles that of the stomach in that it consists of four coats, but its mucous membrane possesses several characteristics. It is thrown into folds, or rugæ, which prevent the food passing too rapidly through the tube, and greatly increase its surface for absorption. The glands are very numerous and secrete the " succus entericus ", or intestinal juice, which aids digestion. Over the surface of the rugæ are innumerable finger-like processes called villi, which are lined with columnar epithelium. Each villus contains a lymph channel or lacteal through which the fat is conveyed as chyle from the intestine, and a meshwork of



INTERNAL ORGANS OF OX (right side)

a, Mouth; *b*, Tongue; *c*, Pharynx; *d*, Epiglottis; *e*, Œsophagus; *f*, Trachea; *g*, Heart; g^1, Anterior vena cava; g^2, Anterior aorta; g^3, Posterior aorta; *h*, Ramifications of blood vessels in lung; *i*, Diaphragm; *k*, Entrance of œsophagus into rumen; *l*, Liver; *m*, Rumen or paunch (1st stomach); *n*, Reticulum or honeycomb (2nd stomach); *o*, Manyplies, psalterium or omasum (3rd stomach); *p*, Abomasum or rennet bag (4th stomach); *q*, Gall bladder; *r*, Small intestines; *s*, Colon; *t*, Cæcum; *u*, Rectum; *v*, Anus; *w*, Right kidney; *x*, Right ureter; *y*, Urethra; *z*, Sheath.

capillaries through which are absorbed into the blood stream the sugars and other foods from the intestinal tract.

The Large Intestine, or great gut, commences at the ileo-cæcal valve and ends at the anus, and, like the small intestine, is divided into three portions:

(*a*) THE CÆCUM, or bung, is about 1½ feet long with a diameter of 4 or 5 inches. At the posterior end is a cul-de-sac, while the anterior end continues into the second part of the large intestine called the colon.

(*b*) THE COLON, which is about 3 inches in diameter and 33 feet in length, is arranged in coils above the small intestine supported by the mesentery.

(*c*) THE RECTUM, or terminal portion of the large intestine, is about a foot long. Extending from the lower end of the colon it passes through the pelvis and opens at the root of the tail to the exterior, through the anus or vent. It forms a dilatation at the termination of the colon in which the fæces are retained until they are voided through the anus.

The total length of the large intestine of the ox measures about 36 feet; that of the sheep 20 feet; that of the pig 16 feet, while the great gut of the horse is some 28 feet in length.

The mucous membrane of the large intestine is rich in glands which, for the most part, secrete mucus. The globular columnar cells of the lining membrane have the power of absorbing fluids from the intestinal contents. As in the small intestine, lacteals and blood-vessels abound in the submucous coat, and into these the various food constituents are absorbed. In the ox the large intestine is a more or less plain tube, while in the horse and pig the gut is sacculated by means of muscular and fibrous bands.

ACCESSORY DIGESTIVE GLANDS

Three sets of glands secrete fluids which assist digestion: (*a*) the salivary glands (these have been discussed on p. 32); (*b*) the pancreas, the secretion from which passes into the duodenum through the pancreatic duct; (*c*) the liver produces bile which is evacuated through the bile duct into the duodenum.

The Pancreas is an elongated, lobulated gland of a brownish yellow colour. It lies across the great vessels of the abdomen on the right side overlapped by the stomach and attached to the liver. In function it is a true gland, each lobule consisting of groups of

gland cells arranged around a central duct. These ducts join to form the pancreatic duct, which opens into the duodenum and discharges the pancreatic juice into the small intestine to assist in the digestion of food. In addition to the digestive juice, the pancreas forms an "internal" secretion which when absorbed into the blood-vessels and lymphatics assists in the assimilation of sugar by the tissues of the body.

The Liver is the largest gland in the body. It is of reddish-brown colour, and is situated between the posterior surface of the right half of the diaphragm (to which it is attached by means of peritoneal bands) and the stomach. It is firm and elastic, and has two surfaces, the anterior, or diaphragmatic, which is thick and slightly concave, and the posterior, or stomachic, which is thin and somewhat flattened. There is a depression on the posterior surface called the hilus, and at this point the vessels enter and leave the organ.

The liver of the ox has three (poorly divided) lobes, the largest is on the right, a smaller lies to the left, while a small lobe behind and above the main liver mass is known as the "thumb piece". Situated low down on the stomachic surface and projecting from the sharp liver edge is a pear-shaped sac, known as the gall bladder, in which the bile is stored.

The entire gland is made up of small polygonal-shaped lobules, each connected to an artery carrying pure blood, and a branch of the portal vein carrying blood from the intestines containing the food materials absorbed from the intestinal tract. From each lobule passes a vein carrying the impure blood from the liver to the posterior vena cava, and a bile duct which carries the juice or bile formed by the liver cells to the gall bladder. Round about the vessels which enter and leave the hilus of the liver are situated the hepatic lymphatic glands, which the meat inspector will frequently be called upon to examine.

The liver of the sheep is similar to that of the ox, but is smaller and the lobes are much more distinct. The colour is lighter particularly in lambs. The liver of the pig has four distinct lobes and a small thumbpiece, and the surface is lobulated (separated into lobes or divisions) with strongly developed interlobular tissue between. The liver of the horse has four lobes, but is distinctive in that it has no gall bladder.

The liver of the ox weighs from 12 to 14 lb. or about one eighty-fifth part of the total weight of the animal.

The functions of the liver are mainly to form bile and to store sugar. The bile is manufactured by the liver cells from substances carried to the liver by the portal vein. It contains bile salts which are capable of emulsifying fats, and bile pigments manufactured from blood corpuscles destroyed in the spleen. The carbohydrates brought from the intestines to the liver by the portal vein are converted by the liver cells into glycogen and stored as such until required, when it is reconverted into sugar and passed on to the tissues.

DIGESTION AND ABSORPTION IN THE INTESTINES

The chyme, or food, which enters the intestine through the pylorus is passed along the gut by means of rhythmic muscular contractions or worm-like movements known as " peristalsis ". These cause the food to pass down the canal, and also press it against the intestinal walls; there is in addition a churning motion whereby the contents of the intestines are continually being mixed. The chyme is acted upon by the intestinal, pancreatic, and liver juices and rendered absorbable in the following ways:

(*a*) The fats, split up by the bile and pancreatic juice, are emulsified and absorbed along with the soluble albumoses into the lymphatic vessels of the intestinal villi. This fluid, known as chyle, is collected in the receptaculum chyli (see page 53) and conveyed by the thoracic duct into the blood.

(*b*) The proteid substances are converted into soluble peptones by the succus entericus and the pancreatic juice, and are absorbed into the veins of the intestine.

(*c*) The starches are converted into sugars by the pancreatic juice aided by the intestinal juices and are absorbed into the intestinal veins from which they are conveyed by the portal vein to the liver. They are converted in that organ into glycogen and stored until required for use.

The bile acts not only as an emulsifier of fats, but assists to stimulate peristalsis, and to inhibit putrefactive changes.

While it has been seen that important digestive processes occur in the small intestine in addition to the absorption of the digested food into lacteals and veins, little true digestion takes place in the large intestine of the ox, the main activity of this portion of the gut being that of absorption. Owing to the presence of putrefactive bacteria, however, fermentation takes place, which splits up the residue of the food. The cellulose splitting bacteria convert the cellulose into sugars and other absorbable substances, while the remainder of the food, which has been deprived of most of its fluid constituents, becomes semi-solid and is passed from the anus as fæces.

THE EXCRETORY SYSTEMS AND EXCRETION

As a result of the chemical changes taking place in the tissues of the body, various waste products are formed which must be eliminated if health and life are to be maintained. This is effected by the excretory organs, namely, the lungs, the skin, and the kidneys.

(*a*) The lungs—the manner in which carbon dioxide and small quantities of watery vapour are exhaled from the lungs is explained in Chapter IV (p. 51).

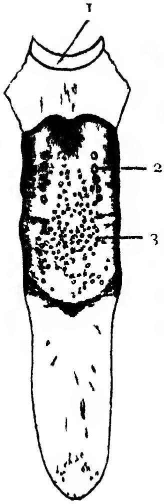
(*b*) The skin acts as an excretory organ, a certain amount of carbon dioxide, small quantities of soluble salts, and water being excreted as sweat from the ducts of the sweat glands which open on the surface of the skin.

(*c*) The kidneys are the main organs of excretion: they dispose of nitrogenous waste products, soluble salts and excessive water.

The Urinary System consists of the kidneys, which separate the urine from the blood; the ureters, which convey the urine from the kidneys to the bladder, which acts as a reservoir for the urine; and the urethra, or duct, which conveys the urine from the bladder to the exterior.

THE KIDNEYS are two in number, and are situated in the region of the upper loin, on either side of the first three lumbar vertebræ beneath their transverse processes. The kidneys of the ox are lobulated, long-shaped structures, with the hilus situated at the centre of the concave inner edge of each organ. The vessels enter and leave at the hilus, and the ureter, or urinary tube, leaves the kidney at that point. The left kidney of the ox is " floating ", that is to say it has a relatively long attachment which permits of a certain freedom of movement. The kidneys of some of the domestic animals are simple. A table setting out the differences in the kidneys of the various animals will be found on p. 43. In well-nourished animals the kidneys are enveloped in an extensive layer of fat which conceals them from view in the carcass. In lean animals, or those suffering from some form of wasting disease, the fat in this region is scanty.

A normal kidney is reddish-brown in colour and firm in consistence, and is surrounded by a thin membrane or capsule which is readily stripped off. When sectioned the kidney is found to be composed of three parts: an external or cortical portion, an inner or medullary portion, and the pelvis or central part—which is the dilated commencement of the ureter. The cortex is granular in

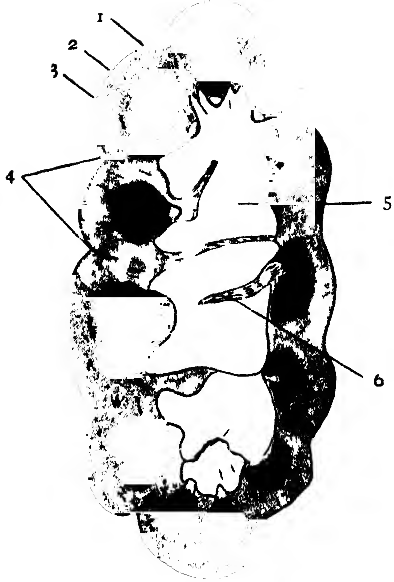


TONGUE OF OX

1 Epiglottis 2, Circumvallate papillae 3, Fungiform papillae

TONGUE OF HORSE

1 Epiglottis 2 Circumvallate papillae



LONGITUDINAL SECTION THROUGH KIDNEY OF OX

1 Thin membranous capsule 2 Medullary portion 3 Cortical portion 4 [illegible] 5 Fat surrounding the pelvis 6 Tube or calyx opening into the pelvis

POSTERIOR OR STOMACHIC SURFACE OF OX LIVER

1 Left lobe 2, Right lobe 3 Spigelian lobe 4 Entrance of portal vein surrounded by lymphatic glands embedded in fat 5 Gall bladder

appearance, with numerous small red spots scattered through its substance. These are formed by a tuft, or network, of capillaries surrounding a small tubule, the tuft being known as a glomerulus. The tubules are convoluted but become straight at the end where they enter the medullary portion of the kidney. In the medulla are numerous cone-shaped pyramids with their apices directed toward the pelvis of the organ: they are composed of a large number of tubules, conveying the urine which has been separated from the blood in the cortex into the pelvis or expanded ureter.

THE URETERS are membranous tubes which conduct the urine from the kidneys to the bladder.

THE BLADDER is an elastic sac or reservoir in which the urine is collected and retained until it is voided. It is a pelvic organ when empty but projects into the abdomen when distended with urine. It is pear-shaped, the apex forming the posterior end of the organ where it opens into the urethra.

THE URETHRA is the tube which conveys the urine from the bladder to the exterior. In the female, it is short, while in the male it is long and narrow, coming to the exterior at the tip of the penis.

THE URINE is a straw-coloured fluid, consisting of water, salts, and nitrogenous waste products derived from the blood. The quantity voided depends on the amount of fluid consumed, on the diet, and on the weather temperature. An ox in health passes from 15 to 40 pints of urine daily; the sheep from ½ to 1½ pints; the pig from 3 to 13 pints, and the horse from 8 to 14 pints daily.

APPENDIX B

STOMACH CHARACTERISTICS OF THE DOMESTIC ANIMALS

Animal	Type of Stomach	Shape	Comparative Size	Capacity
Horse.	Single.	Curved sac, constricted in the middle.	Small.	4 gall.
Cattle.	4 compartments:			
	Rumen	Very large, 2 lobes.	Very large.	Over 30 gall.
	Reticulum	Small, honeycombed.		
	Omasum	Oval, many leaves.		
	Abomasum	Pear-shaped.		
Sheep.	do.	do.	Large.	About 5 gall.
Goat.	do.	do.	Slightly smaller.	
Pig.	Single.	Almost kidney-shaped.	Large.	2 gall.
Dog.	Single.	Pear-shaped.		

Variations in the Tongues of the Domestic Animals

Animal	Shape	Dorsal Ridge	Surface	Circumvallate Papillæ	Epiglottis
Horse.	Long, narrow, thin; end spatular.	Absent.	Smooth; blackspots never occur.	One on each side of the thickest part of the tongue	Pointed.
Cattle.	Thick, tapering; end pointed.	Marked.	Rough black spots common.	Six or more on each side.	Semi-circular with bones in base.
Sheep.	Thick, short; tip round.	End hollowed out.	Smooth, spots common.	Nine to twelve on each side.	Semi-circular.
Goat.	Like sheep.	End hollowed out.	Smooth, spots common.	Twelve on each side.	Semi-circular.
Pig.	Long, thin; pointed end.	Absent.	Smooth, velvety.	One on each side.	Broad, rounded.
Dog.	Flat; end rounded.	Median groove.	Slightly rough.	Two or three on each side.	Rhomboid.
Cat.	Flat; end rounded.	Median groove.	Rough.		

Livers of Various Domestic Animals

Animal	Lobes		Approximate Weight	Gall Bladder
	Number	General Shape		
Horse.	4	2 outer, large; 2 inner, small. No thumbpiece.	11 to 14 lb.	Absent.
Cattle.	3	Badly separated; right, large, thick; left, thinner; small thumbpiece above and behind.	12 to 14 lb.	Present; pear-shaped
Sheep.	3	2 distinct; 1 thumbpiece.	1 to $1\frac{1}{2}$ lb.	Present
Pig.	5	2 small outer; 2 small inner; 1 thumbpiece.	3 to 4 lb.	Present.
Dog.	7	Lobes very uneven in size.		Present.

Intestinal Characteristics of the Domestic Animals

Animal	Small Intestine		Large Intestine		
	Length	Diameter	Length	Capacity	Dimensions
Horse.	70 feet.	3–4 inches.	28 feet.	44 gallons.	Much larger than small gut and sacculated.
Cattle.	140 feet.	2 inches.	36 feet.	17 gallons.	Little larger than small gut. Non-sacculated.
Sheep.	80 feet.	1 inch.	20 feet.		Same as cattle, only smaller.
Pig.	56 feet.		16 feet.		Wider than the small gut and sacculated.

Kidney Characteristics of Domestic Animals

Animal	Type	Approximate Weight	Colour	Shape	
				Right	Left
Horse.	Simple.	2 lb. each.	Deep reddish-brown.	Heart-shaped	Bean-shaped.
Cattle.	Lobulated, 15 to 20 in each.	$1\frac{1}{2}$ lb. each.	Deep reddish-brown.	Oval, flat and fixed.	Triangular; floating.
Sheep.	Simple.	2 oz. each.	Dark deep red.	Bean-shaped.	Bean-shaped.
Goat.	do.	do.	do.	do.	do.
Pig.	Simple.	5 oz. each.	Paler red.	Shape of long bean.	Shape of long bean
Dog.	Simple.	5 oz. each.	Pinkish red.	Shape of short bean.	Shape of short bean.

CHAPTER IV

Circulatory and Respiratory Systems

The Circulatory System: The Blood—Coagulation of Blood—the Heart—the Blood-vessels—Course of Circulation—Pulmonary System—Systemic Circulation—Portal Circulation.

The Respiratory System: Nostrils—Pharynx—Larynx—Trachea—the Lungs—Respiration—the Pleura.

THE BLOOD AND THE CIRCULATORY SYSTEM

Blood is a nutritive fluid which circulates throughout the animal body. It consists of two portions—a fluid and a cellular part. The former is known as the " plasma ", or " liquor sanguinis ", and is a straw-coloured fluid, containing water, salts, nutritive substances derived from the food, waste products from the tissues, and protective substances.

In the plasma are suspended myriads of very minute bodies known as blood corpuscles. These are of two kinds—white and red. The red corpuscles, which are much more numerous than the white, consist of circular biconcave discs possessing no nucleus but having a thin membranous capsule forming a fine meshwork throughout the cell in which is a substance known as hæmoglobin, or the red colouring matter of the blood. The latter possesses the power of taking up oxygen from the air in the lungs and of giving it off in the tissues, where it aids oxidation, or combustion.

The white corpuscles, or leucocytes, are of many varieties, but all possess a nucleus. They serve as scavengers, or cleaners of the body, having the power of attacking and destroying bacteria, and may be regarded as a line of defence against bacterial invasion of the animal tissues. Leucocytes destroy and ingest damaged tissue cells, but if the invading bacteria are too numerous or too powerful they may kill the leucocytes which then become " pus cells " or " matter ".

The chief functions of the blood may be summarized as follows:

(*a*) It conveys nutriment, absorbed from the food in the alimentary canal, to all parts of the body.

(*b*) It carries oxygen from the lungs to the tissues where the process of oxidation takes place, namely, the burning up of useless and undesirable accumulations resulting in the purification of the tissues and the production of energy and animal heat. Oxygen is converted in the tissues into carbon dioxide which is carried by the blood to the lungs, where it is eliminated from the body.

(*c*) It collects waste products from the tissues and conveys them to the kidneys, where they are separated from the blood and excreted in the urine.

(*d*) It acts as a defence against the invasion of organisms into the tissues and neutralizes some poisons, or " toxins ".

(*e*) It distributes heat throughout the animal body.

The blood going from the lungs to the tissues (arterial blood) is of a bright red colour due to the presence of a large excess of oxygen obtained in the lungs, whereas the blood returning from the tissues to the heart and lungs (venous blood) is of a dark purple colour, having parted with its oxygen to the tissues and having received a large quantity of carbonic acid gas in its stead.

Blood Clotting.—In the vessels of the body the blood is in a fluid condition, but shortly after withdrawal, instead of remaining fluid, it becomes viscid and gelatinous and finally " sets " into a firm jelly-like mass. If this is placed on one side for a few hours it separates into two portions—a firm red clot containing the blood cells and a clear translucent straw-coloured fluid termed the blood serum. Coagulation is due to the deposit of a protein known as fibrin, which sets on exposure to the air and carries down with it the enmeshed blood corpuscles.

THE CIRCULATORY SYSTEM

The circulatory system comprises the heart and blood-vessels.

The Heart is the pump which forces the blood through the blood-vessels. By its rhythmic contraction and relaxation the blood is circulated throughout the body.

The heart is a pear-shaped, hollow, muscular organ, of a dark red colour, situated in the thorax between the anterior lobes of the lungs. It lies within a closed membranous bag formed of two layers of serous membrane called the pericardium (or " bag "). One layer covers the heart closely, the other forms the containing " bag " or " sac ". Between the layers of the pericardium a little fluid is found, which allows the one layer to move on the other without friction. The heart may be regarded as a double organ composed

of a right and left half, completely separated from one another by a partition-wall. Each side of the heart has two chambers—an upper called an auricle, which communicates with a lower called a ventricle. There is, therefore, a right auricle and ventricle, and a left auricle and ventricle. Between each auricle and ventricle a valve is placed which allows the blood to pass from the auricle into the ventricle, but not in the reverse direction.

The heart valves are composed of a comparatively thin membranous-like material and have little knob-like swellings on their outer edges.

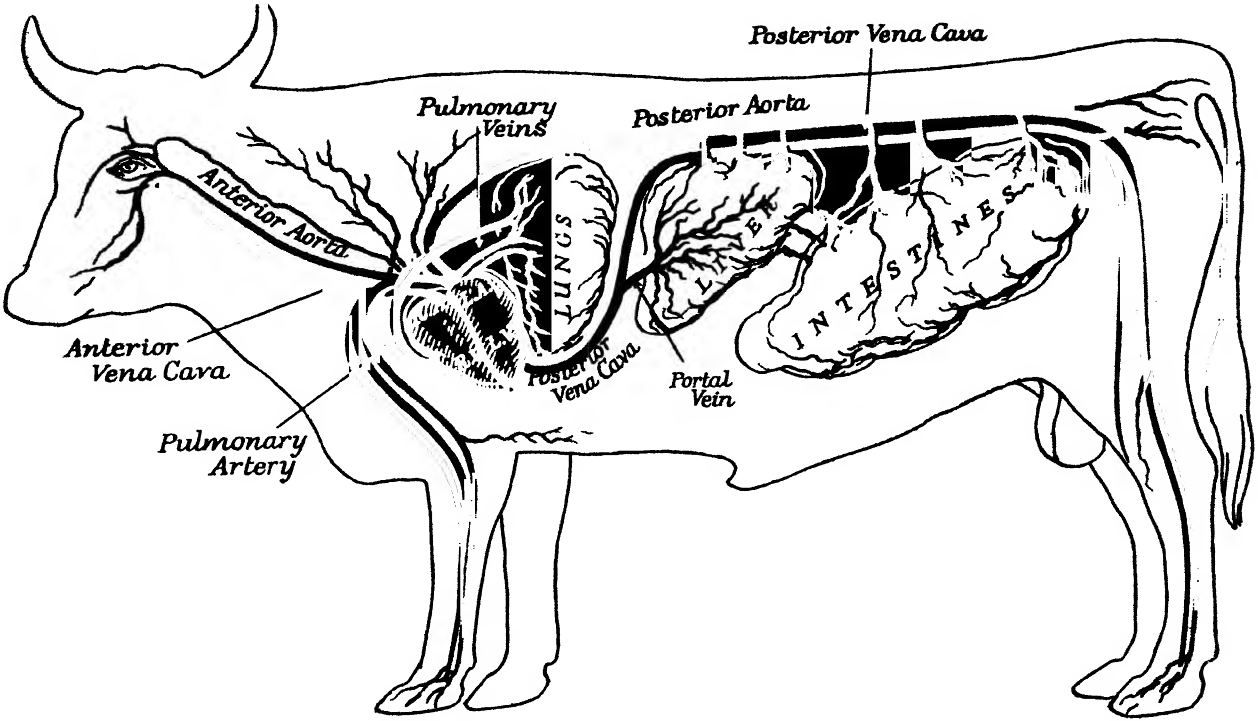
On sectioning the heart wall of slaughtered animals which have been properly bled, comparatively little blood is found in the chambers. The coronary vessels, which lie in a furrow on the outer surface of the wall of the heart, enveloped in a little white or yellow adipose tissue, should also contain but little blood.

The ox heart is more pointed than that of the horse, and contains in the partition between the auricles two bone-like structures not found in the heart of the latter animal.

Blood-vessels.—Tubes, or blood-vessels called veins, bring the blood to the heart, and other vessels, called arteries, take it away from the heart to the body. Blood is returned into the right auricle from the head, neck, and fore-limbs by a large vein, the anterior vena cava, and from the hinder part of the body by another large vein, the posterior vena cava. From the left ventricle the blood is forced by contractions into the great artery called the aorta, which conveys it to all parts of the body.

ARTERIES have thick walls with many elastic fibres in the inner and outer coats and muscle fibres in the middle coat. They carry pure, or arterial, blood from the heart to the whole body. They are filled with blood, and, at each contraction, or beat, of the heart more blood is pumped into the arteries, distending their elastic walls, the impact being felt as the pulse. The elastic tissue in the vessel wall recoils after distension, and the artery returns to its former size. By means of this elastic recoil aided by the contraction of the muscle fibres, the blood is propelled through the vessels till it ultimately reaches the smallest arteries, or arterioles, and from them enters the capillaries.

THE CAPILLARIES are minute tubules which form a fine network throughout the body, connecting the arterioles with the veins. Their walls are composed of endothelial cells, through which the oxygen and nutritive materials contained in the blood exude to



CIRCULATION OF OX—DIAGRAMMATIC

reach the tissues, and are exchanged for carbon dioxide and waste products; the latter entering the capillaries flow back to the heart in the venous blood stream.

THE VEINS contain impure or venous blood, and are thin-walled tubes with little elastic tissue. Valves are placed at intervals along the veins; these open towards the heart so that blood which has once passed through them cannot pass back again. The venous blood flows to the right side of the heart from which it passes to the lungs for purification.

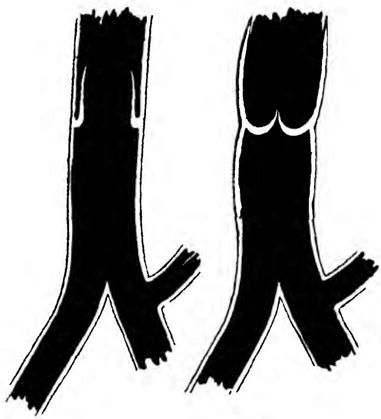


Fig. 17.—Diagrammatic Section of Vein

Course of the Circulation.—The right and left sides of the heart are quite distinct from one another, the chambers on one side being separated from those on the other by a partition of muscular tissue.

There are two main systems of circulation, called respectively the pulmonary, or lesser, and the systemic, or greater, each of which has a special function to perform. In the pulmonary system the blood in passing through the lungs loses its carbon dioxide and is charged with oxygen. By means of the systemic circulation, in which the blood passes to all the various organs of the body, the nutrition of the tissues and the elimination of waste products is effected.

Pulmonary System.—In the pulmonary system the blood is driven by the contraction of the right ventricle into the pulmonary artery, which divides into two branches, one going to each lung. Each branch divides into smaller arteries in the lungs, and then into minute capillaries. Purification of the blood (exchange of carbon dioxide for oxygen) takes place in these pulmonary capillaries which unite together to form veins, in which the purified blood is brought back to the left auricle.

Systemic Circulation.—The blood having passed from the left auricle into the left ventricle is driven by the contraction of its muscular walls into the great systemic artery called the aorta. The latter gives off branches called arteries which convey the blood to all parts and organs of the body. The arteries divide up into smaller and smaller branches until at length they become hair-like

vessels, no longer visible to the naked eye, called capillaries. These capillaries of the systemic circulation unite to form veins which gradually increase in size, those from the anterior part of the body uniting to form a large vein called the anterior vena cava, and those from the posterior part uniting to form the posterior vena cava. The venæ cavæ convey the blood back to the heart, where it is discharged into the right auricle. From the right auricle the blood passes through the valve into the right ventricle—in order to go through the same cycle once more. In its passage through the systemic capillaries the blood gives up its oxygen and the nutritive materials which it contains to the tissues, and receives in return carbon dioxide and the waste products produced by the metabolic processes which go on in the body, thus becoming changed from pure arterial blood, which is scarlet in colour, into impure or venous blood, which is of a dark bluish tint.

Besides the main systemic system there is also a subordinate circulation—the portal circulation.

Portal Circulation consists of the blood from the stomach, intestines and other abdominal organs which is gathered into a single stream and conveyed by the portal vein to the liver, through which organ it passes before reaching the heart again. The blood passing to the liver in the portal vein contains the nourishing substances which have been absorbed from the chyle of the intestines. These are given up to the liver cells, where they are converted into glycogen and other substances, and the blood then passes to the heart via the hepatic vein and posterior vena cava.

The Pulse.—The throb of the heart beat, or pulse, is caused by the impulse of the blood against the vessel wall due to the pumping action of the heart which drives blood into the vessels which already contain blood. The vessels distend, giving a wave-like impulse which can be appreciated by the finger. In the healthy ox, the pulse beats 45 to 50 times per minute.

THE RESPIRATORY SYSTEM

The respiratory organs comprise the nostrils, nasal chambers, pharynx, larynx, trachea, and the lungs.

The Nostrils are separated from one another by a cartilaginous bridge, and, together with the nasal chambers, pharynx, larynx, and trachea, are lined by a smooth mucous membrane

which in healthy animals appears moist, due to the secretion of a small quantity of watery mucus.

The Pharynx is the back part of the throat which communicates directly with the mouth. The nasal chambers enter it from above, while the openings of the larynx and œsophagus, or gullet, are below.

The Larynx is a tube-like structure which connects the pharynx with the trachea. It contains the vocal chords. The epiglottis is a leaf-like lid which closes over the opening of the larynx during the act of swallowing, thus preventing food from entering the respiratory tract.

The Trachea, or wind pipe, is a tube made up of a large number of incomplete cartilaginous rings bound together by bands of muscular and other tissues. It commences at the larynx and passes down the front of the neck (below the gullet) into the thoracic cavity, where it divides into two branches (three in the ox, sheep, and pig) called bronchi, which are similar in structure to itself, one of which enters each lung.

The Lungs are two in number—a right and a left. They fill the space in the thoracic cavity (not already occupied by the heart, great vessels and the œsophagus). The lungs are separated from the abdomen by the " skirt " or diaphragm. They are voluminous, spongy, elastic organs, which normally contain air in their air-chambers. They are light and porous in texture, and a piece of healthy lung if put into water will float. Each lung is divided into three or more main lobes by deep fissures on its lower border. On entering the lung the bronchus divides and subdivides into smaller and smaller tubes, called bronchial tubes. The smallest of these terminate in groups of air cells known as " alveoli ". The arrangement of the air cells and their tubules is in clusters resembling a bunch of grapes.

The alveoli are lined by one fine layer of pavement epithelium, the tubes by ciliated epithelium throughout their entire length. There are many elastic fibres in the tissues around the air cells, and in the tube walls, which admit of the necessary elasticity for contraction and expansion. The lungs are supplied with dark venous blood by the pulmonary arteries which proceed from the right ventricle of the heart. These arteries divide and subdivide into smaller and smaller branches, penetrating every portion of the lungs and forming capillary networks which are spread over each air cell. The walls of the air cells and of the fine capillaries are extremely

thin and thus the blood is brought into intimate contact with the inspired air.

The Pleura.—The surfaces of the lungs are covered by a smooth, shining, semi-transparent serous membrane called the pleura. After covering each lung the two layers come off between these organs in the middle line, and ascending in an upward direction become attached to the vertebral column. The space in the thorax between these two layers of pleura is called the mediastinum, in which are situated the mediastinal lymphatic glands (which are of great importance to the meat inspector) as well as the œsophagus or gullet.

After ascending to the vertebral column, the two layers of pleura diverge, and sweeping downwards and outwards, clothe the internal surface of the thoracic walls (ribs, sternum, and diaphragm). The pleura lining the thoracic wall is known as the parietal layer, in contradistinction to the visceral layer, which covers the lungs.

In the process of dressing the animal carcass, the lungs, or "lights" as they are sometimes called, are removed along with the trachea and gullet and are hung up near the carcass from which they were removed ready to be examined by the inspector. The trachea may be recognized by its cartilaginous rings, the œsophagus by the fact that it is more flexible and muscular in structure. With the lungs hanging so that the œsophagus is toward the inspector and the trachea away, the right lung will be on the inspector's right and the left on his left, and he will have their dorsal surfaces along with the mediastinal glands toward him. (See Plate V, p. 56.)

The left lung of the ox is divided into three lobes, the right into four or five. The lungs of sheep and goats resemble those of cattle in miniature. The right lung of the pig has either three or four lobes, the left two or three.

Respiration consists of the rhythmical expansion and contraction of the chest wall, produced by the action of the intercostal and abdominal muscles and of the diaphragm. With each expansion an inward breath is taken, known as an inspiration, the diaphragm is pulled backwards, the ribs are pulled apart by the intercostal muscles, and the lungs expand and become filled with air. With each contraction air is expired or forced out of the chest, the diaphragm and chest walls returning to their former position. The air in the lungs is thus continually renewed by the acts of inspiration and expiration. In the capillary network around the air cells the blood is brought into intimate contact with the inspired air. Through the agency of the hæmoglobin contained in the red blood corpuscles,

the venous blood becomes converted into bright red arterial blood by exchanging the carbon dioxide gas collected in the tissues of all parts of the body for the oxygen gas absorbed from the air contained in the air cells. The oxygenated blood is collected by small veins directly connected with the capillaries. These veins unite to form larger veins which ultimately pour their contents through the pulmonary veins into the left auricle of the heart.

The inspired air is cooler, contains less watery vapour, and possesses a higher percentage of oxygen, while that forced out of the lungs in the act of respiration is warmer, contains a high percentage of watery vapour, some organic impurities excreted from the animal tissues, and its oxygen content is markedly reduced.

The normal rate of respiration in the ox is about 12 per minute, that of the sheep from 8 to 10, while that of the pig is about 13 per minute.

A table showing the variations in the heart and lungs of the domestic animals appears on page 52.

APPENDIX C

Heart and Lung Characteristics of the Domestic Animals

Animal	Trachea	Lungs				Heart	
		Bronchi	General	Right Lobes	Left Lobes	Shape	Fat
Horse.	Rings of cartilage overlap at their ends.	One right. One left.	Lungs very long, lobules not very well defined.	3	2	Short, not pointed, no bone in base.	Scanty and oily in 2 coronary furrows.
Cattle.	Ends of cartilages meet at an angle and form a ridge down the trachea.	Two right. One left.	Bright red, firm and elastic, with much interlobular tissue. Distinct lobulation of surface.	4–5	3	Large and pointed, irregular Y-shaped bone in the base of the left ventricle.	Firm and white in 3 coronary furrows meeting at the apex.
Sheep.	Same as cattle.	Two right. One left.	Dense and leathery, less rosy in colour.	4–5	3	Same as cattle in miniature, but no bone.	Fat very white in 3 coronary furrows. Sets very firm.
Pig.	Same as cattle, but much shorter.	Two right. One left.	Long and broad, very spongy; the fingers meet easily through the tissue. Lobules in squares well marked and less interlobular tissue than in cattle.	3–4	2–3	Like the horse.	Soft and less than in cattle.

CHAPTER V

The Lymphatic System

Lymphatic Vessels — Lymphatic Glands — Lymph — Site — Location—Drainage Area and Efferent Distribution of the Chief Lymphatic Glands.

By means of the lymphatic system, lymph is circulated throughout the animal body. It consists of lymphatic vessels, lymphatic glands, and lymph.

The Lymphatics, which closely resemble veins, are thin-walled tubes which originate with open ends in small spaces in the tissues, called lymphatic spaces. The lymphatic system is in close relationship with that of the circulation of the blood. The plasma, or fluid portion of the blood, constantly transudes through the thin-walled capillaries, bathing the surrounding tissues and carrying with it oxygen and nourishment for their support. Thereafter it makes its way into the lymphatic spaces from which it is removed by the lymphatics, so that in health no accumulation takes place.

The flow of lymph from the lymphatic spaces is maintained partly by muscular contraction, which presses upon and empties the lymphatics, and partly by pressure from the fluid which collects in the lymph spaces, the lymphatic vessels being provided with valves which prevent the lymph passing in a backward direction. The lymph capillaries arising in the various parts of the body unite to form larger vessels, or lymphatics, which convey the lymph to the lymphatic glands. (The lymphatics of the villi of the small intestine are known as " lacteals ", as they carry the milk-like chyle from the intestines to the mesenteric glands, and thence to the thoracic duct.) After traversing one or more lymphatic gland, the lymph is conveyed from them by other lymphatics which join to form two large trunks —the thoracic duct and the right lymphatic trunk.

THE THORACIC DUCT originates near the first lumbar vertebra, in a dilatation known as the " receptaculum chyli " (because the chyle from the intestine is received into it), and collects lymph from

the whole body with the exception of the right fore-limb and the right side of the head, neck, and chest.

THE RIGHT LYMPHATIC VEIN is a short duct which receives the lymph from the right fore-limb, the right side of the head, neck, and chest, and pours it into the axillary vein. It will be seen that the lymphatics are the means by which that part of the exuded blood plasma or lymph which has not been absorbed by the tissues is collected and returned into the blood stream. No lymph can regain the circulation by entering the thoracic duct or right lymphatic vein without first passing through at least one lymphatic gland.

Lymphatic Glands.—These occur as nodes situated on the course of the lymphatic or lacteal vessels, and are round, oval, or more commonly bean-shaped. They are of a whitish-grey or greyish-blue colour, and vary much in size from that of a pinhead to a hen's egg, being relatively larger in young than in older animals. Each gland has a depression on one side, called the hilus, through which the efferent lymphatics pass (those vessels which convey the lymph away after it has passed through the gland), while the afferent vessels (those which carry lymph to the gland) enter the organ at different parts of the periphery. Lymphatic glands are usually rather firm in consistence; those of the abdominal cavity, however, being softer than those of the trunk and extremities. Each gland is enclosed in a firm capsule of connective tissue, from which processes (or trabeculæ) extend into the gland substance forming a meshwork with intervening spaces or sinuses. The gland tissue proper is composed of masses of cells, or follicles, which form an outer, or cortical, and an inner, or medullary, zone, the two parts varying only in the form of the cells, these in the cortical zone being round, while those in the medullary area are elongated. Lymph cells are formed in the gland substance, pass out in the lymph, and enter the blood where they are known as white blood corpuscles.

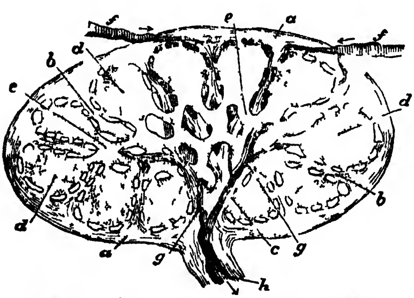


Fig 18.—Structure of a Lymphatic Gland

a, capsule, *b*, fibrous strands passing into gland, *c*, similar strands in centre, *d*, lymph nodules, *e*, nodules of different spaces communicating, *f*, lymph vessels entering gland; *g*, *h*, lymph vessels leaving gland.

The Lymph is exuded blood plasma and consists of a fluid and a cellular portion. It conveys oxygen and food to the tissues

and removes from them waste materials. On reaching a gland the lymph passes between the trabeculæ and is filtered during its passage through the gland: it parts with gross impurities such as carbon particles and bacteria. From the gland it receives lymph cells and fibrin (a substance which aids coagulation), both of which are manufactured in the gland. Thus on leaving a gland, lymph is purer than on its entry, and in addition it is richer in cell-content and has greater power of coagulation. The lymph which is collected in the lacteals of the intestine is milk-like owing to the presence of fat, and is known as chyle.

The lymph from each region of the body is conveyed by the lymphatics to one special gland or set of glands. Thus each gland, or set of glands, receives its lymph from a certain " corresponding " region, as it is termed, and from that region only. Lymphatics in the same region communicate freely with one another; communications do not exist, however, between the lymphatics of two anatomically separate parts. If, therefore, a lymphatic gland is diseased, the disease must have originated in the corresponding area of the animal's body.

It is very important that the meat inspector should be able to locate and cut down upon the lymphatic glands, as evidence of disease may frequently be found in these structures more readily than in any other part. A list of the more important lymphatic glands is set out stating their situation, means of location, the area from which they derive their lymph supply, and the area to which their lymph is distributed.

THE PRINCIPAL LYMPHATIC GLANDS

Position of Glands in the Ox, the Manner of Locating Them, their Distribution Area and their Efferent Distribution

S = site. L = location. D.A. = drainage area.
E.D. = efferent distribution

Glands of the Head.

SUBMAXILLARY.

S. Superficial, on the inner side of the lower jaw near its angle, about 2 inches anterior to the point at which the lower jaw curves upwards. (See Plate V.)

L. With the tongue in the severed head make a longitudinal incision just within the angle of the lower jaw. The gland is close to the submaxillary salivary gland.

D.A. The lower half of the head (nose, cheek, mucous layer of the mouth, tip of the tongue, mucous membrane of nose, head, and gums).

E.D. The upper cervical glands.

PAROTID.

S. On the outside of the cheek near the parotid salivary gland, about 1 inch in front of the ear and a little lower than the external meatus of the ear, posterior to the articulation of the jaw. (See Plate V.)

L. Make a deep incision through the salivary gland under which will be found the parotid lymphatic gland.

D.A. The ear, the parotid salivary gland, the temporal region part of the base of the skull.

E.D. The upper cervical glands.

RETROPHARYNGEAL.

S. On either side of and posterior to the pharynx near to the attachment of the cornu of the hyoid bone to the skull. They are relatively large glands.

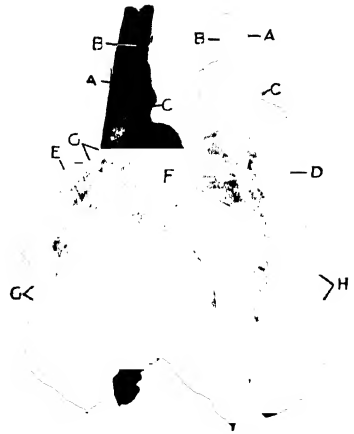
L. Place the head face downwards on the table with the base towards the operator, raise the cut end of the trachea with the left hand, feel for the hyoid bone, and make a lateral cut in this position. The glands are generally exposed in the removal of the tongue.

D.A. The cranial cavity, base of the skull, ear, parotid gland, and remainder of the tongue.

E.D. The lower cervical glands. (See Plate V.)

Glands of the Carcass.

CERVICAL GLANDS.—The cervical glands are sometimes divided into upper, middle, and lower cervical glands. The division is somewhat arbitrary, as the upper and middle glands form a more or less continuous chain, while the lower cervical group consists of two distinct larger glands. The upper and middle cervical glands are therefore grouped together in the following description:



TWO PAIRS OF OX LUNGS

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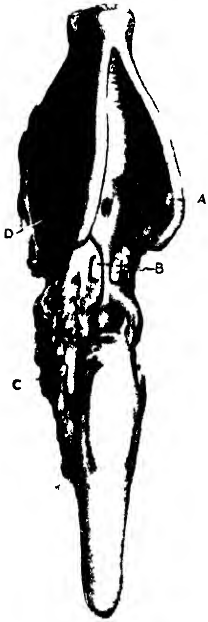
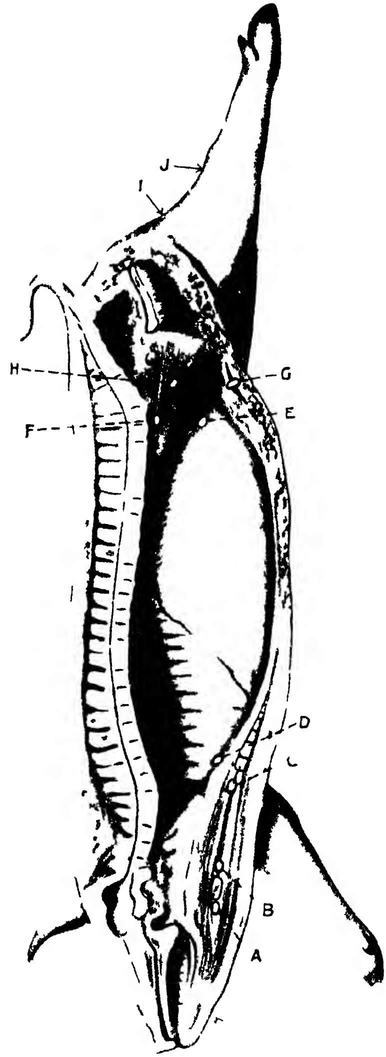


OX HEAD

(showing position of lymphatic glands)

A Left C Right submaxillary glands B Retropharyngeal glands D Right parotid gland



CARCASS OF PIG (inside view)

A Submaxillary B Upper cervical glands with the submaxillary s[illegible] gland lying between them C Superficial and deep prepectoral D Suprasternal E Precrural F H Internal iliac glands G Superficial inguinal glands I Popliteal glands, J Lymphatic glands above the hock

Upper and Middle Cervical Glands.

S. A chain of small glands on either side of the neck in the jugular furrow. They lie close to the thyroid gland on the posterior wall of the pharynx, larynx, and upper third of the trachea, and are frequently removed during the dressing of the carcass.

L. Incise in the jugular furrow along the course of the vessels.

D.A. The cranial cavity, base of the skull, larynx, pharynx, and submaxillary gland.

E.D. The lower cervical glands.

Lower Cervical Glands.—The lower cervical glands consist of (*a*) superficial or presternal, and (*b*) lower or deep cervical.

(*a*) *Presternal.*

S. One or more superficial glands at the entrance to the thorax on the anterior border of the first rib.

L. Incise between the first and second ribs on the inner side of the carcass. (For D.A. and E.D. see Lower Cervical.)

(*b*) *Lower Cervical.*

S. Immediately beneath the presternal glands under the scalenus muscle. (See Plate VI.) The scalenus muscles arise from the tubercles of the cervical vertebræ and are attached to the first and second ribs.

L. Cut through the scalenus muscle. Start the incision at the centre of the first rib and cut through the muscle in a line parallel to the border of the neck.

D.A. Upper and middle cervical, prescapular and axillary glands, and lymph vessels of the head and neck.

E.D. Right—to the right lymphatic trunk. Left—to the thoracic duct.

These are very important glands, as all the lymph from the head and neck passes through to reach the thoracic duct. Tuberculous lesions can be detected after removal of the viscera as the disease is often found in these glands.

Axillary or Brachial Gland.

S. Beneath the scapula and its muscles, embedded in the fat about midway along the second rib.

L. From the outside of the carcass—only after removal of the scapula and its muscles.

From the inside of the carcass. Take out a segment of the first intercostal space midway between the vertebral column and the sternum: the gland will be found on the outer side of the second rib.

D.A. The outer wall of the thorax and the scapula.

E.D. The lower cervical glands.

Prescapular.

S. On the outside of the carcass embedded in fat in front of the shoulder joint. (See Plate VII.)

L. Incise one handsbreadth from the point of the shoulder towards the neck, deep in the fat.

D.A. The superficial glands of the neck, shoulder, arm, and fore-arm.

E.D. The lower cervical glands.

The drainage area is not connected with that of any other part. Therefore if there is secondary tuberculous disease in this gland it must have arisen in a generalized infection through the blood stream.

Precrural.

S. On the outside of the carcass in the anterior fascia of the groin.

L. Make a longitudinal incision on the outside of the carcass along the centre of the groin fascia.

D.A. The anterior part of the thigh and outer abdominal wall.

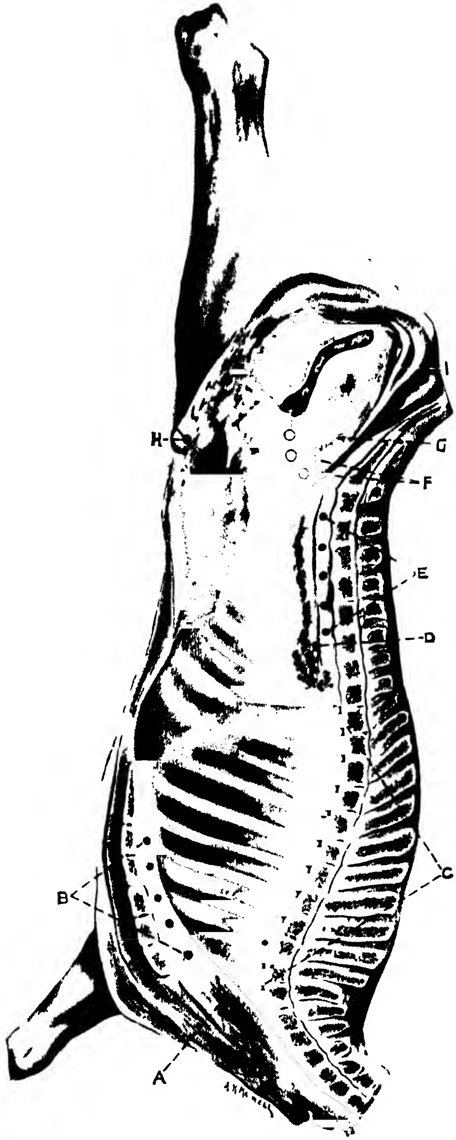
E.D. The sub-lumbar glands.

Superficial Inguinal (male): Supramammary (female).

S. In the male the superficial inguinal gland is situated in the cod-fat at the neck of the scrotum and side of the penis. In the female, the supramammary gland is situated above and behind the udder.

L. Superficial inguinal: incise 1½ inches deep at the base of the cod-fat in a straight line between the pubic tubercle and the cod-fat.

Supramammary: make an incision about 2 inches in length and 1½ inches deep in a straight line from the pubic tubercle to a point where the udder appears to join the flank.



CARCASS OF OX (inside view)

A, Prepectoral or lower cervical glands; B, Supra-sternal glands; C, Intercostal glands; D, Renal glands; E, Sub-lumbar glands; F, External and internal iliac glands; G, Deep inguinal; H, Superficial inguinal glands embedded in the "cod fat"; I, Ischiatic gland.

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D.A. The external genitals, the inferior abdominal wall, and median femoral region.

E.D. The deep inguinal glands and the thoracic duct.

These glands are most important in cows, as tubercle of the udder is a common primary lesion and infection of the gland results.

DEEP INGUINALS.

S. At the inlet of the pelvis in the femoral canal.

L. Make an incision at the distal edge of the loin suet about 2 inches under the pubic tubercle in a line inclined towards the sacrum.

D.A. The popliteal, superficial inguinal, and supramammary glands, the penis, and the thigh.

E.D. The sub-lumbar glands and the lymphatic duct.

These glands are often absent and if present are small.

POPLITEAL.

S. Deep down in the popliteal space in the centre of the round of beef, immediately above and behind the stifle joint, embedded in the fat. (See Plate VII.)

L. Cut through the thigh muscles immediately above and posterior to the stifle joint, on the track of the femero-popliteal artery.

D.A. The external surface of the hind-quarter.

E.D. The deep inguinal and pelvic glands.

SUBDORSAL.

S. A chain of small glands situated in the loose connective tissue between the aorta and the dorsal vertebræ.

L. If the aorta is in situ, incise in the dorsal region between the artery and the vertebræ.

If the aorta has been removed, a few of the glands of the chain will be found by incising the connective tissue near the point where the diaphragm and dorsal vertebræ meet; the remainder will be located by incising the mediastinal tissue around the aorta.

D.A. The dorsal vertebræ and the back muscles.

E.D. The thoracic duct.

INTERCOSTAL or DORSO-COSTAL.

S. Small glands situated in the intercostal spaces, on either side near the junction of the ribs with the vertebræ, partly embedded in the muscles.

L. Incise the fatty tissue of the intercostal spaces close to the vertebræ, start the incision from the lower border of the rib above and extend to the upper edge of the rib below. The glands in the second, third, and fourth interspaces are partly embedded in the muscles. The glands are pale in colour and small and may be overlooked in the fat which surrounds them.

D.A. The intercostal spaces, the anterior surface of the diaphragm, and the peritoneum.

E.D. The thoracic duct.

SUPRASTERNAL.

S. Between the costal cartilages of the first six ribs, near their junction with the sternum, following the course of the internal thoracic vessels under the triangularis sterni muscle. The anterior glands of the chain lie superficially on the anterior surface of the sternum, one on each side. (See B, Plate VI.)

L. Make an incision a little above and parallel to the sternum in a line with the vessels, about three inches inwards from the anterior edge of the sternum.

D.A. The anterior surface of the diaphragm and the intercostal muscles.

E.D. Right—the right lymphatic duct. Left—the thoracic duct.

XYPHOID.

S. Just inside the highest point of the sternum to the inside of the xyphoid cartilage.

L. Incise the piece of fat found on each side hanging from the sternal end of the diaphragm. The gland will be found in the centre or thickest portion of the fat.

SUB-LUMBAR.

S. A chain of glands on either side of the posterior aorta, covered by the lumbar muscles in the loin region, close to the lumbar vertebræ.

CARCASS OF OX (outside view)

A, Prescapular glands; B, Precrural glands; C, Popliteal glands

L. Incise the fat along the abdominal aorta on either side in the suet. Commence the incision at the highest lumbar vertebra and continue down in an almost straight line for 1½ inches inwards from the vertebra to the pelvis of the kidney.

D.A. The abdominal wall, the lumbar muscles, and the organs in the pelvic cavity.

E.D. The thoracic duct (the receptaculum chyli).

External and Internal Iliacs.

S. Close to the arteries of the same names. (See F, Plate VI.)

L. Internal iliac. Incise at the junction of the iliac arteries. Take a straight line at right angles from the top of the last lumbar vertebra towards the flank. The gland will be found 2 inches from the lumbar vertebra embedded in the loin suet.

External iliac. Make an incision along the iliac artery, i.e. incise on the same line as above about 7 inches from the lumbar vertebra and 1½ inches deep.

D.A. The pelvic organs and lateral femoral region, the side of the lower abdominal wall, and the precrural glands.

E.D. The sub-lumbar glands.

Ischiatic.

S. Outside the pelvic cavity under the ischiatic notch, midway along a line drawn from the posterior end of the sacrum to the highest point of the aitch bone. (See I, Plate VI.)

L. Incise the *outer side of the carcass* between the ischium and the biceps femoris muscle, at the level of the ischiatic notch.

Take a line on the *inner side of the carcass* from the tip of the posterior end of the symphysis pubes towards the last lumbar vertebra. The gland is deeply embedded under the muscle just below the lower border of the posterior end of the symphysis.

D.A. The popliteal gland and the sacro-coccygeal muscles.

E.D. The sub-lumbar glands.

N.B. In tuberculosis of the udder the ischiatic gland may be the only one which shows tuberculous lesions.

Sacral.

S. On the inferior and lateral aspect of the sacrum.

L. Incise near the lateral border of the sacrum.

D.A. The upper pelvic wall and the rectum.

E.D. The sub-lumbar glands.

Visceral Glands and Glands removed with the Viscera.

Anterior Mediastinal.

S. A chain of glands in the mediastinal tissue between the lungs anteriorly. (See G, Plate V.)

L. Incise the folds of the anterior mediastinum. The glands lie close to the œsophagus between the lungs.

D.A. The heart, pericardium, and the diaphragm.

E.D. Right—the lymphatic trunk. Left—the thoracic duct.

Posterior Mediastinal.

S. In the mediastinal tissue beneath the aorta. (See H, Plate V).

L. Incise the tissue between the lungs close to the œsophagus at the level of the aortic arch.

D.A. The mediastinal membrane, œsophagus, pleuræ, diaphragm, anterior abdominal region, and the anterior surface of the liver.

E.D. The bronchial and anterior mediastinal glands and the thoracic duct.

The glands are generally found in situ in the dressed carcass as are also the anterior mediastinal glands.

Bronchial.

S. On either side of the trachea near its point of bifurcation those on the left lie immediately under the arch of the aorta. (See C, D, E, Plate V.)

L. Incise from above downwards along the side of the trachea to its point of bifurcation.

D.A. The lungs and posterior mediastinal glands.

E.D. The anterior mediastinal glands and the thoracic duct.

Gastric.

S. These glands are found embedded in the fat along the omental attachment of the rumen on the course of the vessels.

L. Incise along the omental attachment of the rumen.

D.A. The walls of the stomach.

E.D. The receptaculum chyli.

SPLENIC.

S. In the gastro-splenic ligament at the hilus of the spleen.

L. Incise the ligament at the hilus of the spleen, but when the spleen has been removed the glands are often attached to the rumen and practically form one of the gastric chain.

D.A. The spleen.

E.D. The larger lymphatics of the digestive organs.

MESENTERIC.

S. In the mesentery along the lesser curvature of the intestines a little distance from them.

L. Palpate the mesentery and incise each gland where felt.

D.A. The intestines. The chyle from the intestines flows through these glands.

E.D. The receptaculum chyli.

These glands are frequently infected with tubercle.

PORTAL OR HEPATIC.

S. On the posterior surface of the liver embedded in the fat in the hilus. (See Plate IV.)

L. Incise the fat at the hilus of the liver.

D.A. The liver.

E.D. The receptaculum chyli.

RENAL.

S. Embedded in the fat at the hilus of the kidney, opposite the second lumbar vertebra. (See Plate VI.)

L. Incise the fat at the hilus of the kidney on the course of the renal artery almost facing the second lumbar vertebra.

D.A. The kidney.

E.D. The thoracic duct.

ANAL.

S. Alongside the rectum and anus.

L. Incise the fat covering the extreme lower border of the ischium. (These glands are as a rule removed with the anus and rectum in dressing the carcass).

D.A. The lower portion of the rectum and the anus.

PIG GLANDS WHICH DIFFER FROM THOSE IN CATTLE

The glands in the neck of pigs are very numerous, and below the submaxillary they form a more or less continuous and indistinguishable chain.

1. Submaxillary.—They are more posterior than in cattle, and lie under cover of the submaxillary salivary gland. They are located by making an incision through the submaxillary gland, or by hooking it aside and incising underneath it.

2. Parotid.—In swine they form a chain of large glands along the anterior border of the parotid salivary gland posterior to the border of the lower jaw. Often one or more is left on the inner surface of the jaw after removal of the head.

3. Retropharyngeal.—Much smaller and more posteriorly situated than in cattle. On the lateral plane of the larynx and pharynx about the level of the styloid process of the occipital bone.

4. Superior and Middle Cervicals.—These form a continuous chain.

5. Prescapular.—These form a more or less fused chain. The position corresponds to that in cattle but can be cut from the inside.

6. Axillary or Brachial.—Often absent in hogs, and the lymph from the area passes into the middle and inferior cervicals.

7. Precrural.—This gland in hogs is got at from the inner side of the carcass by making an incision nearly perpendicular to the vertebræ in front of and above the articulation between the femur and tibia.

8. Popliteal.—Often absent in hogs, but a gland which takes its place is found 3 or 4 inches above the hock in the subcutaneous tissues.

9. Supramammary.—One or more glands on each side posterior to the last segment of the compound mammary gland.

10. Suprasternal.—Generally replaced by one large gland at the articulation of the first and second sternal segments.

11. Posterior Mediastinal.—These are four or five small glands on the superior surface of the aorta.

12. Renal.—Found on either side of the renal artery where it rises from the aorta.

13. Gastric.—Three or four large glands under the pancreas in the lesser curvature of the stomach.

14. Mesenteric.—Further removed from the bowel than in cattle, and nearer the centre of the omentum, and more lobulated than in the ox.

15. Portal or Hepatic.—Found round the portal vein at the foramen of Winslow. They are often separated when the liver is removed and will be found in the fat near the gastric glands. (See Plate V.)

CHAPTER VI

Nervous and Reproductive Systems, and Ductless Glands

The Nervous System: The Central Nervous System—the Brain—Spinal Cord—Medulla—the Nerves. The Autonomic Nervous System. Functions of the Nervous System. Special Senses.
Ductless Glands: Thymus, Thyroid, Pituitary, Pineal Suprarenals, and Spleen.
The Reproductive System: Male Organs—Testicles—Vasa Deferentia—Prostate—Penis. Female Organs—Ovaries—Fallopian Tubes—Uterus—Vagina—Vulva. The Udder.

THE NERVOUS SYSTEM

The nervous system consists of two separate but related parts —the central nervous system and the autonomic system.

The Central Nervous System comprises the brain, which is the great nerve centre situated in the head of the animal; the spinal cord, or main conductor of messages to and from the brain, situated in the spinal canal of the vertebral column; and the nerves branching off from the brain and spinal cord to supply all the tissues and organs of the body.

THE BRAIN consists of the cerebrum or great brain, the cerebellum or lesser brain, the pons or bridge, and the medulla.

The great brain is divided into two halves or hemispheres by a deep fissure. It consists of an external layer of nerve cells forming the grey matter, and an inner portion, mainly composed of nerve fibres, and forming the white matter of the brain. The cerebellum is smaller than the cerebrum, but like it has nerve cells on the outer surface and nerve fibres internally. Both cerebrum and cerebellum are irregular in contour, being ridged, or convoluted, the cerebrum with large and the cerebellum with smaller convolutions. The cerebrum occupies the anterior portion of the brain-box, the cerebellum the posterior part, and from the latter an elongated prolongation called the medulla connects the brain with the spinal cord.

THE SPINAL CORD is a long white cord, composed on the outside of nerve fibres, with a grey centre of nerve cells. The brain and cord are enveloped within three membranes which protect and nourish them. The blood-vessels do not penetrate nerve tissue but are conveyed to every part of it in the covering membranes. The brain contains groups of cells or " centres " which are responsible for will, motion, and sensation, and which control the main body functions. The centres for respiration, circulation, and many other important functions are situated in the medulla.

THE NERVES convey motor and sensory impulses to and from the brain. Those which carry impulses to the brain from the periphery, such as those of heat, cold, touch, and pain, are called afferent, ingoing, or sensory nerves; while the outgoing impulses of motion, either for contraction of muscles or for the secretion of glands, are conveyed in the efferent, or motor nerves. In addition, there are connecting nerves which link up each part of the nervous system one with the other.

The Autonomic or Self-governing System supplies nerves to all the involuntary muscles of the body—in the heart, lungs, digestive and reproductive systems—and to the walls of the blood-vessels by means of which their size is controlled.

The two last paragraphs relate to the nervous system as a whole and not to the autonomic system in particular.

The function of the nervous system is to co-ordinate and control the various activities—muscular, glandular and special—throughout the body. Nervous matter acts as a medium between the will and the muscles. If an animal wishes to move, impulses are transmitted from the brain through the nerves to the muscles concerned. The nerves do not produce motion by their own contraction but by their influence over the muscles in which they terminate.

The " special senses " of seeing, hearing, tasting, and feeling are all supplied with nerve cells adapted for the sense which they are required to convey. The eye has specialized nerve cells conveying the impressions of light, form, &c. The ear has complicated nerve endings and cells capable of receiving and transmitting sound impulses. The tongue is provided with various specialized cells for the interpretation of different flavours. The skin contains nerve endings of various types capable of conveying impressions of touch, heat, cold or pain. Impulses are carried from all these cells and are interpreted in the brain which controls and presides over the functions of the animal body.

DUCTLESS GLANDS

A number of important glands possess neither afferent nor efferent vessels. They are termed ductless glands and include the thymus, thyroid, pituitary, pineal, and spleen.

Thymus Gland.—A gland situated in the mediastinum which is large in young animals but decreases as age advances. It is whitish-yellow in colour, lobulated, and consists of two parts—the one in the neck called the cervical; the other in front of the heart called the thoracic portion. The gland is composed of lymphoid tissue surrounded by a firm capsule. The exact function of the thymus is unknown, but, as it is large during the period of growth of the young animal and thereafter degenerates and is in large part replaced by fibrous tissue, it is thought to have some relation to the growth or development of the animal. The thymus of calves and lambs is used for food and is called the " sweetbread ".

The Thyroid, a two-lobed gland with a connecting isthmus, is situated in the neck—one lobe on either side of the larynx and trachea. The gland is surrounded by a capsule from which processes extend into the gland substance dividing it into sections. The glandular cells are large and secrete a colloid material which assists development and calcium metabolism. If it is deficient the young animal does not grow normally and a stunted deformity results, while insufficient thyroid secretion in the adult gives rise to various changes, including swelling of the subcutaneous tissues, decreased mental activity, &c.

The gland of the sheep is used for the preparation of " thyroid extract " which is utilized for medicinal purposes in man.

The Pituitary Gland is found at the base of the skull beneath the brain and is divided into two main parts—anterior and posterior. The secretions of the former are associated with the development of bone and the growth of the sexual organs, while that from the latter influences blood pressure and causes uterine contractions. Other actions of the secretions are connected with the secretion of urine and the sugar content of the blood.

The Pineal Gland is a small ovoid body situated on the surface of the brain between the cerebrum and cerebellum. It is believed to influence sexual maturity and extracts are made from it for use in cases of mental backwardness.

The Suprarenals are oval glands situated on the upper

borders of the kidneys. Each gland is divided into outer cortical and inner medullary zones, and secretions are formed in each part. That from the cortex is said to influence sex development and to have other metabolic action, while that from the medulla acts on the involuntary muscles and central nervous system through its adrenalin secretion.

Extracts containing adrenalin are made from the medullary zone of the glands of sheep, and are used medicinally to stop bleeding, and in asthma to relax the bronchi and bronchioles.

The Spleen, or melt, is a large ductless gland situated in the upper and left part of the abdomen, and in the ox attached to the paunch or rumen. It varies in colour, sometimes being reddish-brown, sometimes greyish-blue or even dark purplish-red and is of soft consistence. When incised its interior is found to consist of a reddish-brown matrix through which very small white follicles are scattered. The spleen capsule is firm and sends a fine meshwork into the organ. The red spleen pulp is found in the spaces between the trabeculæ, while the white follicles (called "Malpighian corpuscles") are small masses of lymphoid tissue situated around the arteries. The spleen is a so-called "blood gland" in which white corpuscles are manufactured, red blood corpuscles are broken up and the iron they contain is stored. In young animals the red blood cells are formed in great numbers in the spleen. (This also takes place after a severe hæmorrhage in the adult).

It has been estimated that blood going to the spleen contains white blood corpuscles in the proportion of one to four hundred, whereas the returning blood has as high a number as one to fifty.

The spleen varies considerably in form in the different domestic animals. A table will be found on p. 71 setting out the chief characteristics.

REPRODUCTIVE SYSTEM

The reproductive system comprises: In the male—two testicles, two vasa deferentia, accessory glands, and the penis. In the female—two ovaries, two Fallopian tubes, the uterus, the vagina, and the vulva.

Male Organs.

THE TESTICLES are two oval glands contained in a pendulous sac, known as the scrotum. They produce the spermatozoa or male elements of reproduction.

THE DEFERENT DUCTS or VASA DEFERENTIA convey the spermatic fluid containing the spermatozoa from the testicles to the urethra. The tubes are long and convoluted, and in them the spermatozoa are stored. They pass from the scrotum into the pelvis and open one on each side into the first part of the urethra as it leaves the bladder.

THE ACCESSORY GLANDS AND DUCTS, which consist of the prostate gland and the vesciculæ seminales, are on the floor of the pelvis in close relation to the pelvic portion of the urethra.

THE PENIS, or pizzle, is the male organ of copulation, and contains the urethra. The posterior end of the organ is attached to the ischial bones. Each attachment is surrounded by the erector muscles, the contraction of which leads to the erection of the organ during copulation. These muscles are well developed in the bull and form one of the criteria by which the sex is distinguished in the animal carcass.

Female Organs.

THE OVARIES produce the eggs or ova. They are oval organs, one on each side of the pelvis, held in position on either side of the uterus by means of ligaments. In addition to the ova they produce very important internal secretions.

THE FALLOPIAN TUBES originate with fringed ends close to the ovaries, one on each side, and pass inwards to the anterior horns of the uterus, with which they become continuous. They serve as the ducts for the conveyance of ova from the ovaries to the uterus.

THE UTERUS, or womb, is a hollow muscular organ in which the young animal is developed until such time as it can live apart from its mother, when it is born. In the cow the uterus has two anterior projections or horns, which unite to form the body of the organ.

THE VAGINA is a muscular tube or passage, lined with mucous membrane, which extends from the uterus to the vulva. The penis of the male animal is introduced into the vagina in the act of copulation and it is through the vagina that the young animal is expelled at birth.

THE VULVA is the external opening of the vagina at the " vulvar cleft ", the point at which it reaches the exterior.

Extracts are made from the male and female sex glands of animals and are used for medicinal purposes in man.

The Udder, or mammary gland of the cow, is situated on either side of the flank. It consists of two parts, separated by a

septum, each half divided into two quarters, each of the four quarters possessing a teat with a central milk duct. The gland tissue is similar to that of all true glands. The secreting gland cells surround small ducts, which unite with those from other gland sections and ultimately form the central milk duct of the teat. The ducts of one quarter do not communicate with those of another: each quarter forms a separate milk unit. In young animals which have not yet calved the udder is comparatively small and forms a smooth rounded elastic swelling which on section is seen to be composed mainly of fat, the gland tissue being little developed. After the first calf, the gland tissue is more fully developed and the organ is softer and less rounded. In the old cow, which has borne several calves, the udder is soft and pendulous and on section is brown in colour and of spongy texture. The supramammary lymphatic gland is situated above and on the outer side of the posterior quadrant of each half of the udder embedded in fat. This gland is of prime importance to the inspector as an indication of the healthy or unhealthy condition of the udder.

APPENDIX D

Spleen Characteristics of Domestic Animals

Animal	Shape	Approx. Weight	Colour	Position
Horse.	Long, flat, sickle-shaped, pointed one end.	2 lb.	Violet if fresh.	Left side upper abdomen.
Cattle.	Thin, long, flat, with rounded edges.	3 lb.	Cow, dark grey; ox, reddish-brown.	Left side attached to the rumen.
Sheep.	Blunt, angular, oyster-shaped.	3 oz.	Reddish-brown	Usually attached to the " pluck " in the dressed carcass.
Pig.	Very long, narrow, and tongue-shaped, with a ridge of fat on one side.	4–6 oz.	Bright red.	To the left of the stomach, not found attached to the " pluck ".
Dog.	Tongue-shaped.		Pale reddish-brown.	To the left in the upper abdomen.

Section II.—Diseases of Animals—Signs—Post-mortem Appearances and Judgment

CHAPTER I

Abnormal and General Pathological Conditions

Poorness of Condition—Emaciation—Variations in adipose tissue—Imperfect bleeding—Suffocation—Immature and Fœtal Flesh—Wounds—Degenerations—Fatty and Cloudy Swelling. Infiltrations—Fatty, Melanotic and Lime Deposits. Fevered Flesh. Inflammation—Pneumonia, Pleurisy, Pericarditis, Peritonitis, Nephritis, Hepatitis, Mastitis, Glossitis, Necrosis.

GENERAL PHYSIOLOGICAL AND PATHOLOGICAL CHANGES

Before describing the signs, symptoms, and pathological changes brought about by individual diseases, it will be convenient to consider certain general physiological and pathological changes which the meat inspector should be able to recognize.

Poorness of Condition.—Animals well advanced in age, male animals which have been used for service, milk cows, and animals in the course of development, are, as a rule, found to be in lean condition. Their flesh is generally darker in colour, but is firm to the touch, and there is marked scarcity of fat. Such meat is not unwholesome. It shrinks, however, on cooking, possesses a less agreeable flavour than that of fattened animals, and is tough.

Emaciation.—In this condition the poorly nourished state of the animal is due to some pathological cause; it differs, therefore, from " poorness ", which may be found in healthy animals. The meat of emaciated animals is soft and flabby, and the fat is replaced by gelatinous tissue.

Judgment.—The fitness of emaciated meat for human consumption depends upon the degree of emaciation, and on the nature of the disease which has given rise to it. The entire carcass and all the organs should be condemned if there is evidence of general pathological emaciation. (Memo. 62, Foods, Sec. V *A* 10. See p. 164.)

Variations in Adipose Tissue under different Circumstances.—The adipose tissue, or fat, of animals fed on certain pastures or of different breeds of cattle—such as the Jersey—may assume a yellow instead of the normal white colour. This must not be mistaken for jaundice, in which not merely the fat but also the muscles, bones, marrow, connective tissue, and intestines assume a yellow colour. If a section of the liver of an icteric (jaundiced) animal be examined under the microscope, crystals of bilirubin are found in the tissues.

Imperfect Bleeding.—Weak heart action preventing the blood from being pumped out of the vessels when the animal is bled gives rise to signs in the carcass and organs. The cause may be that the beast was killed when dying, to "save its life" (see p. 211), or it may be due to the method of slaughter. The flesh is dark, the carcass sets badly, the organs are dark and congested, and the left ventricle is full of blood. Such flesh decomposes rapidly, and is unfit for human consumption.

Suffocation may result from choking, drowning, or from trampling or crushing during transport. The organs of a suffocated animal are generally congested, especially the lungs, which contain frothy mucus, sand, or portions of food. The right side of the heart is full of blood and the left empty. The flesh is dark, sets badly, and decomposes quickly.

Fœtal Flesh is the flesh of unborn animals. The eyes may be closed; the hoofs are soft and unwalked upon; the teeth are still totally or partially covered by the gums, while the stomach is empty. The lungs are solid and will sink if put into water. The navel (or site of insertion of the cord into the abdomen) is fresh and its vessels are distended with blood. The flesh is soft, flabby, watery, and contains much glycogen. (See test for glycogen in horse-flesh, p. 189.)

Immature Flesh is that of an animal too immature to produce wholesome meat. In such animals the cord is drying or may have dropped off, the lungs float if placed in water, and there are signs of food in the stomach. The flesh is pale, soft, flabby, and friable so that the fingers easily penetrate it, while the fat is scanty and gelatinous.

Judgment.—If there is evidence of immaturity (see p. 169) still-born, or unborn carcass, the entire carcass and all the organs shall be condemned. (62, Foods, Sec. V *A* 15.)

DEGENERATION

In this condition the albumen of the cell is converted into some other substance. There are two chief forms of degeneration—fatty degeneration and cloudy swelling.

Fatty Degeneration is most frequently found in the liver, heart, and kidneys. Organs thus affected are smaller and softer than normal. The heart and liver assume a reddish-yellow tint and soft flabby consistence. The albumen of the cells is converted into oil, which appears (under the microscope) as strongly refractile granules.

Cloudy Swelling.—The organs are enlarged, grey, opaque, and dull in character, having lost much of their normal colour and sheen. Under the microscope the cells are found enlarged and filled with albuminous granules which obscure the nuclei.

Recognition of the above two conditions is of great importance, because they are commonly associated with serious general diseases, such as anæmia, bacterial infections, or phosphorous poisoning.

INFILTRATION

Tissues may become infiltrated with fat, pigment substances, or calcareous particles.

Fatty Infiltration frequently affects the liver, which becomes enlarged, yellow in colour, while to the touch it is greasy and less firm than normal. Cirrhosis not infrequently accompanies fatty infiltration of the liver. Under the microscope the liver cells are seen to be distended with refractile oil droplets, but the nuclei take up the nuclear stain. Animals fed on the refuse from breweries sometimes suffer from fatty infiltration of the liver.

Melanosis is characterized by the deposit of a black pigment in the tissues and organs of the body. It appears as black points or blotches occurring in the lungs, liver, peritoneum, pleuræ, fasciæ, bones, and cartilage, &c. If examined microscopically, the black coloured spots are seen to be due to a deposit in the tissues of a pigment called melanin.

Judgment.—If there is evidence of generalized melanosis the entire carcass and all the organs should be condemned, otherwise the affected organ or part only need be condemned. (62, **Foods, Sec.** V *A* 21 and *B*.)

Calcification.—Tissues which have become degenerated, generally as a result of disease, frequently undergo calcification, and become hard through the deposit of lime salts. This process is seen in tuberculous lesions of old standing.

FEVERED FLESH

Fevered Flesh generally results from toxins of bacterial origin circulating in the blood. Cloudy swelling may be present in the organs, while the flesh is usually darker in colour than normal, with small hæmorrhages scattered throughout its substance. The peritoneum shows a diffused redness, and the small vessels, which are full of blood, are plainly visible. When fever is severe, the flesh may be " soapy " to the touch and very dark in colour.

Judgment of the fitness of such flesh for human food will depend upon the disease which gave rise to the condition, and is discussed in the sections dealing with the various diseases. If, however, there is evidence of acute fever, the carcass and all the organs should be condemned. (62, Foods, Sec. V *A* 12.)

INFLAMMATION

Inflammation may occur as a result of an injury, or through irritation from the presence of a foreign body, bacteria, or parasites. It gives rise to redness, swelling, and pain. The inflammatory condition may subside or go on to abscess formation, or necrosis (death of the part), or it may become chronic, when it is known as " chronic inflammation ".

In acute inflammation the tissues are congested and full of blood, while the surrounding parts are infiltrated with white blood cells. When abscess formation occurs, there is a more or less definite abscess wall of fibrous tissue containing a yellow fluid, or " pus ". The latter consists of debris and blood cells. In old abscesses the contents may be calcareous (hard from the presence of lime salts). The inflammation may be so acute as to cause death of the tissues or organ affected, sometimes spoken of as " gangrene ".

When the inflammation becomes chronic, enlargement of the tissues results, accompanied by an increase of fibrous tissue. This condition is seen in the " cirrhosis " of the liver which accompanies fluke disease.

Pneumonia, or inflammation of the lungs, may be due to a special infection caused by pneumococci and allied organisms; it may arise during the course of some other disease, or may be set up by parasites in the lungs.

Animals suffering from pneumonia are fevered, the temperature is raised, the pulse quickened, breathing is rapid and may be distressed. Grunting may occur at the end of inspiration. Cough is present, at first dry and short, later accompanied by mucoid discharge. The condition may improve or the animal may die.

There are two forms of pneumonia: (1) Broncho-Pneumonia and (2) Lobar Pneumonia.

1. BRONCHO-PNEUMONIA is produced by the inspiration of foreign material or micro-organisms into the bronchi and bronchioles. Irritation is set up in the mucous membrane of these tubes which gives rise to inflammation. The inflammation spreads into the air vesicles, causing consolidation of that part of the lung in direct connexion with the affected bronchiole. Thus on the cut surface of the lung consolidated patches are found which are indefinitely or sharply defined from the normal pulmonary tissue, while frothy mucus occurs in the bronchioles. The consolidated portions are hard and dense to the touch, and, if cut out, they sink when placed in water as they contain no air. Many such patches of inflamed tissue may occur. Animal parasites (strongyli) give rise to many of the cases of broncho-pneumonia met with in the abattoir.

2. LOBAR PNEUMONIA.—Large areas of pulmonary tissue are involved. The inflammation may extend to the whole of one or more lobes. The affected parts become solid, contain little or no air, are of a reddish-grey colour, and sink when put into water. The interlobular septa appear broader than normal. The appearance presented is indeed more like that of liver than of lung tissue. At a later stage softening of the consolidated area takes place, and pus is generally exuded. Owing to the inflammatory processes, the blood supply to portions of the lung tissue may be cut off, and should putrefactive bacteria gain access through the bronchi and bronchioles, to the dead tissue, gangrene may result.

Judgment.—If the flesh shows evidence of acute fever it should be condemned. If there is evidence of gangrenous pneumonia the carcass and all the organs shall be condemned (Memo. 62, Foods, Sec. V *A* 12 and 25.)

Pleurisy is an inflammatory condition of the pleura. It may extend over the greater part of the pleura, or a small portion of the membrane only may be involved, corresponding to some lesion in the lung. It may be secondary to some diseased condition of the lung, or be the result of a fractured rib, or the penetration of a foreign

body from the stomach. In the early stages the pleura is congested; later it becomes dull and grey, losing its natural lustre owing to a fibrinous exudate which forms a false membrane on its surface. Adhesion between the parietal and visceral layers of the pleura may occur, and, on examination, the one may be found adhering to the other.

Peritonitis, or inflammation of the peritoneum, is caused either by a penetrating wound of the abdominal wall or by perforation of the stomach or intestine, with discharge of contents into the abdominal cavity. The peritoneum may also become infected by spread of septic mischief from one of the abdominal organs —uterus, stomach, intestine, &c. At first the serous membrane appears hyperæmic, then a sero-fibrinous exudate appears on its surface, giving rise to a soft yellow layer, while yellow flakes may be seen in the more fluid part of the exudate. This exudate may glue together surfaces which naturally come in contact with one another, such as loops of intestine, &c., and thus adhesions are formed.

When introduced into the peritoneal cavity, bacteria multiply with enormous rapidity, and, in a few hours, either cause intense inflammation or give rise to septicæmia.

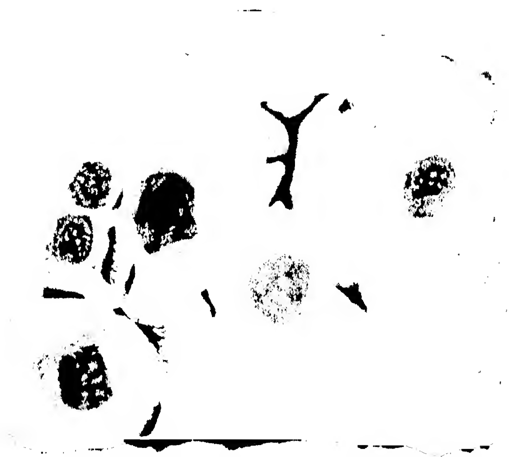
Pericarditis, or an inflammatory condition of the pericardium or " bag ", may arise from the penetration of a foreign body from the second stomach, or may accompany some other disease. The appearances are similar to those found in inflammations of the other serous membranes.

When it results from penetration of a foreign body, such as a nail, from the gullet or stomach, the cause is generally easily detected. The sac may contain putrid smelling fluid if infected by bacteria along the track of the wound. In the early stages there may be a large amount of fluid in the pericardial sac, which may be serous or purulent, and the pericardium sometimes becomes several inches thick resembling leather.

Judgment.—If the flesh is acutely fevered, or if the pericarditis is septic, the whole carcass and all the organs shall be condemned, otherwise the heart only need be seized. (Memo. 62, Foods, Sec. V *A* 12 and 24 and *B*.)

Nephritis, or inflammation of the kidney, may be acute, chronic, purulent, or fibro-plastic.

(*a*) Acute Nephritis is rare. The kidneys are dark and congested, enlarged and full of blood, and the capsule strips readily.



SECTION OF LIVER SHOWING BACTERIAL NECROSIS

COW'S KIDNEYS, SHOWING ACUTE SUPPURATING NEPHRITIS
(Photo by Mr. H. W. Gill, S.I., Folkstone)

Facing p. 80

(*b*) Chronic Nephritis is of more frequent occurrence, most common in old cows. The kidneys are large and pale, and may show hæmorrhages on the surface; they are irregular in shape, and the capsule strips with difficulty. The flesh is emaciated, dropsical, and sets badly.

(*c*) Purulent Nephritis is characterized by abscesses in the kidney. These may be situated either in the cortex or medulla, and are surrounded by a red area of congestion. When in the cortex, the abscesses are generally the result of acute nephritis, or may result from emboli (small portions of blood clot which have blocked a small artery and caused death of the portion of the organ supplied by the artery). Abscesses of the medullary region of the kidney are usually caused by spread of purulent processes from the urethra and bladder.

(*d*) Pyelo-Nephritis.—A purulent inflammation of the pelvis of one or both kidneys. The organ is enlarged, abscesses occur in the cortex, while the pelvis of the affected kidney is distended with pus. The condition is common in cattle and the causative agent is said to be a specific bacillus which affects the ox kidney.

(*e*) Fibro-plastic Nephritis.—In calves a condition known as " White Spot Kidney ", or fibro-plastic nephritis, is of frequent occurrence. It is characterized by the presence of white, wedge-shaped areas scattered over the organ, probably the result of emboli of infective origin. The condition is local but occurs in both kidneys.

Hepatitis.—Inflammation of the liver may be acute, suppurative, or chronic.

Simple acute inflammation of the liver may occur during the course of any of the acute febrile disorders, and is due to the action of toxins or to the bacteria themselves. The organ is enlarged and congested and readily passes on to the condition of fatty degeneration.

Suppuration or abscess of the liver may occur: (*a*) from transportation of bacteria through the umbilical veins in new-born animals (*b*) during the course of pyæmia through the hepatic artery, or (*c*) through spread of infection from the intestines in inflammation of the viscera by means of the portal vein. In cattle, the condition may follow " Bacillary Necrosis ". The abscesses may be single or multiple.

Chronic Interstitial Hepatitis or " Cirrhosis " of the liver is common in all food animals, and consists of an increase in the connective tissue. In the early stages the liver is greatly enlarged, but later, owing to atrophy of the liver cells the organ becomes small, hard, and irregular in shape. In pigs the condition is very common and the liver may be twice its normal size. The disease is attributed to feeding swine on fermenting brewery refuse.

CHAPTER II

Tumours—Diseases of the Blood —Rickets—Rheumatism

Tumours: (*a*) Benign—Cavernous Angioma—Lipoma—Fibroma—Papilloma. (*b*) Malignant—Sarcoma—Carcinoma. (Note—when used in the singular the names of tumours end in *a*, and in the plural in *ata*.)

Diseases of the Blood: Anæmia—Leucocythemia—Jaundice—Uræmia. Rickets. Rheumatism.

TUMOURS

Tumours are nodular neoplasms, or new growths, which arise in the tissues. Nothing is definitely known as to their etiology. They are divided into two classes—benign and malignant.

The benign tumours are strictly local affections, and do not alter the character of the surrounding tissues. Their removal from the organ or part in which they occur is all that is required to render the carcass marketable. When multiple tumours of this sort occur in the musculature, however, the whole carcass and all the organs should be condemned. (62, Foods, Sec. V *A* 33.)

Malignant tumours (sarcomata and carcinomata), on the other hand, have a rapid local growth, infiltrating the surrounding tissues. They may also reproduce themselves by metastasis [1] in other organs, the infective agent being conveyed by the blood or lymph streams to distant parts.

A. BENIGN TUMOURS

Capillary or Cavernous Angiomata.—These are simple tumours of blood-vessels, and occur most commonly in the livers of old cows. They are multiple and vary in size from that of a threepennypiece to that

[1] By metastasis is meant transfer of the tumour from one organ or part to another not directly connected with it. The blood or lymph stream acts as the channel by which some of the living elements of the "primary growth" are carried to a distant part where they form "secondary growths". Sarcomata are spread through the agency of the blood and carcinomata by the lymph.

of a shilling and are found just under the liver capsule, or in its substance, giving rise to dark purplish areas, which, when pressed before clotting has occurred, can be emptied of their blood content. The condition is sometimes alluded to as "plum-pudding liver".

Judgment.—As there is no associated disease of other organs, the liver, when affected, should be condemned as it putrefies rapidly and is unsightly. (62, Foods, Sec. V *B*.)

Lipomata.—Tumours consisting of masses of fat are common in the omentum, and may attain a very large size. They cause no associated disease and the tumour should be cut out, otherwise no further action is necessary. (62, Foods, Sec. V *B*.)

Fibromata.—Tumours composed of fibrous tissue are found under the skin, and in the organs, but are rare and of no importance.

Papillomata.—These worts are common in the pharynx and œsophagus of cattle. They are known as "angle-berries" of the ox, and are of no moment.

B. MALIGNANT TUMOURS OR MALIGNANT NEOPLASMS

These are of two kinds: (*a*) Sarcomata, and (*b*) Carcinomata.

Sarcoma.—A sarcoma is made up of embryonic connective tissue and may be composed either of round or spindle cells, or a mixture of both. As primary growths sarcomata are generally found on the skin, mucous membranes, bones, &c. When in connexion with the skin or mucous membrane, they are greyish in colour, and resemble a lymphatic gland to the naked eye. When in connexion with tendons or periosteum, they are more like fibromata, and when in connexion with bone they are hard and may even be partially ossified. Pigmented forms are met with generally on the limbs of cattle. Should metastasis occur, the sarcoma may spread and become multiple. Secondary deposits are most common in the lungs and liver. In the latter situation they may be confused with tuberculosis: tubercles, however, become caseous in the centre and later become calcified, whereas sarcomata may show caseation but never calcification.

Cancer or Carcinoma is not commonly met with in animals slaughtered for food. The tumour consists of masses of epithelial cells, which grow in finger-like projections, pushing aside and encroaching upon the neighbouring tissues. The cell masses are embedded in highly vascular connective tissue, but there is no definite margin or capsule, so that the growth appears to merge into the surrounding tissues. The softer cancers resemble brain matter, while other forms are hard and fibrous. The colour of the neoplasm is generally grey, but, like sarcomata, may be pigmented. Cancer occurs most frequently in the liver and mucous membranes, and as metastasis occurs through the lymphatics,

the glands which drain the "corresponding area" are usually affected.

Judgment.—The entire carcass and all the organs shall be condemned unless the malignant neoplasms are localized in substance and effect to one organ, when the affected organ shall be condemned. (Memo. 62, Foods, Sec. V *A* 19 and *B*.)

DISEASES OF THE BLOOD

Anæmia may be due to loss of blood through a wound, or may be secondary to a chronic disease, or to the invasion of the animal body by a parasite. The red blood corpuscles may be reduced in number, or the hæmoglobin, which they contain, may be deficient. When anæmia is pronounced, the animal becomes emaciated and listless. Dropsy may be present, and the mucous membranes become pale. The flesh is pale, soft, and watery, and minute hæmorrhages (petechiæ) may be found in the serous membranes and in some of the organs (lungs, &c.).

Judgment.—If the anæmia is pronounced, the entire carcass and all the organs shall be condemned. (Memo. 62, Foods, Sec. V *A* 2.)

Leucocythemia, or leukæmia, is seldom seen in the animals used for food. It is characterized by a marked increase in the number of white blood corpuscles. The ratio of white to red corpuscles in healthy animals is about 1 to 350, while in leucocythemia it may increase to 1 in 50 or even to 1 in 10.

In the live animal the mucous membranes are very pale. The spleen and lymph glands are markedly enlarged. In slaughtered animals the flesh is pale, soft, and watery, while the blood has a milk-like appearance. There are petechiæ in the muscles and tissues, while the bone marrow is lighter in colour than normal. The spleen is greatly increased in size, is firm, and of a bluish red colour supposed to resemble a raspberry. (In anthrax the spleen pulp is tarry.) The lymphatic glands are soft and enlarged in the "lymphatic" variety of the disease. Leukæmic tubercles may be seen on the lungs, liver, and kidneys.

Judgment.—The carcass and all the organs should be condemned, as under anæmia.

Hydræmia.—The chief feature in this ailment is the diminution of the solid constituents of the blood and an increase in its fluid part. The blood is thin in consistence and not very red in colour. Emaciation is generally marked, and there is an accumulation of fluid in the subcutaneous tissues, connective tissue, abdominal and

thoracic cavities, &c., known as " dropsy ". The carcass does not set, the pale red meat is watery, flabby, and soft, and fluid exudes from its whole surface.

Dropsy is seen in many chronic diseases and is well marked in such conditions as " fluke disease " of sheep.

Judgment.—Dropsical flesh is highly unsuitable for human food and must be condemned. In the case of general dropsy the entire carcass and all the organs should be condemned. (Memo. 62, Foods, Sec. V *A* 9.)

JAUNDICE AND URÆMIA

Jaundice.—As a rule jaundice is brought about by blockage of the bile duct, either by bile concretions or parasites, as a consequence of which the constituents of the bile gain entrance to the circulation. The carcasses of animals suffering from jaundice show a yellow colouration: if slight, the colour will be much less evident by artificial light. When practicable, therefore, the carcass should be inspected by daylight. During life, the animal is out of condition, the mucous membranes, conjunctivæ, and skin, are all tinged yellow, while the urine is of a dark greenish brown tint and contains bile. Pigs are frequently affected, but though the carcass may be very yellow shortly after slaughter, it often loses this colouration wholly or partially on becoming cold.

Judgment.—Under Memo. 62, Foods, jaundice requires condemnation of the carcass and all the organs. (Section V *A* 16.)

Uræmia.—In animals, this is generally due to retention of urine in the bladder caused by concretions blocking the urethra, which may lead to rupture of the bladder, discharge of urine into the abdominal cavity; or rupture of the urethra and infiltration of the surrounding tissues. The blood possesses a urinous odour, and there is a urine-like fluid in the subcutaneous and intermuscular tissues. Resorption of urine takes place into the blood, with the result that the flesh has a urinous smell, well brought out on heating or cooking.

Judgment.—Such carcasses, and all the organs, should be condemned. (Memo. 62, Foods, Sec. V *A* 23.)

RICKETS

Rachitis, or rickets, is a disease of young animals, but is seldom seen in " food " animals, with the exception of pigs. The main

changes occur in the bones, especially the long bones. Owing to deficiency in lime salts these become softer than normal and deformities result from the weight of the body. The cartilages at the ends of and between the bones are thickened; the ends of the bones appear broader and larger than normal, and the shafts of the long bones are curved. In addition to the bony changes, there are constitutional symptoms, such as diarrhœa, anæmia, and wasting. The flesh becomes pale and watery.

Judgment.—Where there is evidence of rickets with malnutrition, the entire carcass and all organs should be condemned. (Memo. 62, Foods, Sec. V *A* 27.)

RHEUMATISM

Cattle and pigs are fairly frequently affected by this disease. Such animals generally lie down; when made to rise they move with difficulty and considerable lameness. The affected joints are swollen, painful to the touch, and may exhibit fluctuation. There is, as a rule, no general disease, but, if the rheumatism has interfered with feeding, the animal may become emaciated.

Judgment.—The affected joints show thickening of the tissues, deformity and swelling, and should therefore be excised (62, Foods, Sec. V *B*), but if there is associated generalized emaciation, the entire carcass and all organs should be condemned. (Memo. 62, Foods, Sec. V *A* 10.)

CHAPTER III

Bacterial Diseases

General: Bacteria—Cocci—Bacilli—Spirilla—Filterable Viruses.
Tuberculosis: Animals affected—Formation of a Tubercle—Degenerative Changes which Tubercles may undergo—Local and Generalized Tuberculosis—Primary Lesions—Diagnosis and Differential Diagnosis—Organs and Parts affected by Tubercle Respiratory System—Serous Membranes—Lymphatic Glands—Liver—Kidney—Spleen—Stomach Intestines—Heart and Blood-vessels — Sexual Organs — Bones — Muscles — Blood—Judgment.
Paratuberculosis or Johne's Disease.
Pseudotuberculosis or Caseous Lymphadenitis: Bacteriology—Site of Lesions—Appearance of Lesions—Mode of Infection—Judgment.

General Description.—The greatest number, as well as the most important diseases of animals, are bacterial in origin. Inspectors of meat should have a knowledge of the principles of bacteriology, to guide them in the problems involved in the inspection of meat.

Most of the advances recently made in the science of meat inspection owe their origin to a better understanding of the behaviour of bacteria and their products under different circumstances. The bacteria, which give rise to the infectious or bacterial diseases, are small unicellular organisms composed of protoplasm surrounded by a membrane. They are very small, and can only be seen by the highest powers of the microscope.

Bacteria are distributed everywhere in nature; they cling to the surface of all substances, being found in greater or less numbers in the air, water, dust, &c.

They multiply by fission (or dividing into two), and are termed schizomycetes or fission fungi. They are classified according to their shape into groups:

1. Cocci are spherical in shape. They are called streptococci where they occur in chains, and staphylococci when they form clusters, while pairs of cocci are termed diplococci.

2. Bacilli are straight rods.

3. Spirilla are curved or spiral rods.

Pathogenic organisms are those which produce disease in the living

animal body. Saprophytic bacteria, on the other hand, to which the group of putrefactive bacteria belongs, grow only in dead bodies or in those parts of the living body whose tissues are dead owing to their blood supply having been cut off.

Certain of the organisms which give rise to disease in domestic animals may set up similar conditions in man, e.g. the bacilli of tubercle, anthrax, and tetanus. Many of the most serious diseases of animals are, however, not communicable to man, e.g. swine erysipelas, contagious pleuro-pneumonia, rinderpest, &c.

Pathogenic bacteria may cause disease in one of two ways, either as a direct result of their own activity or indirectly through the agency of poisonous substances, called toxins, which they produce. This is of importance because, though certain organisms may of themselves be incapable of producing disease in man, nevertheless the toxins which they produce may be highly injurious to human health.

Most bacteria and many of their toxins are destroyed by a high degree of temperature, yet, on account of the poor conductive property of meat, it is questionable whether the inner layers of large joints are raised to a sufficient temperature in the process of cooking to render harmless the bacteria and toxins which they may contain.

Filterable Viruses.—Many diseases are caused by organisms of so small a size that they can pass between the pores of a porcelain filter, and are, of course, so small as to be invisible. Such diseases of animals as cow-pox, foot-and-mouth disease, swine fever, pleuro-pneumonia of cattle, and rabies are attributed to filterable viruses.

TUBERCULOSIS

As tuberculosis is the disease most frequently seen in the abattoir, it is essential that the meat inspector should possess a thorough knowledge of its manifestations. It is produced by the entrance of the tubercle bacillus into the system.

Animals Affected.—Cows are more frequently affected than oxen, and old cows more so than young ones. Thus tuberculous lesions are comparatively rarely found in animals under one year, while in old milch cows the disease is common.[1] Pigs are prone to the disease, whilst sheep are seldom, if ever, affected.

[1] While it is true that tuberculosis is uncommon in young animals, it must not be supposed that they are entirely free from it. It would seem that about 1 per cent of calves are affected with the disease, and cases in which it occurs in new-born calves are by no means rare. We are generally taught that tuberculosis is not conveyed directly from the mother to the offspring, and that tuberculous calves contract the disease by drinking infected milk. Unquestionably the latter mode of infection is much the more common, but the former also occurs. In calves affected with congenital (derived from the mother) tuberculosis the disease is very often confined to the lymphatic glands, and the manner in which these structures are affected is very characteristic. Thus the portal glands

BOVINE TUBERCULOSIS WITH DISEASED GLANDS IN SITU
(Photo from Mr J D Allan Chief Food Inspector Liverpool)

Signs and Symptoms of Tuberculosis in the Living Animal.—The detection of the disease in live animals is often difficult or impossible. It may attack many different organs and parts, and the clinical signs vary according to the part involved. In living pigs the diagnosis is particularly difficult and what follows applies to cattle only.

In tuberculosis of the lungs the animal may have a hollow cough, which may be induced by pressure on the larynx. When the disease is advanced the respirations become rapid and laboured.

Too much reliance should not be placed on the animal's condition. In advanced cases of lung tuberculosis, the animal is generally lean and scraggy, with a rough, often hidebound coat, such animals being known in the trade as "piners", but it is only in the later stages that nutrition is seriously impaired. Where emaciation is a prominent feature, tuberculosis of the pleura or peritoneum may be suspected.

In tuberculosis of the udder, the conditions vary according to the stage of the disease, which generally commences in one quarter, the posterior being as a rule affected first. The affected quarter is generally enlarged. On palpation (examination by touch) firm nodules about the size of a pea or hazel-nut, separated from one another, may be detected. Other quarters may thereafter become diseased The whole udder may be swollen, and, in the later stages, very hard to the touch.

Whenever tuberculosis of the udder is suspected, an examination of the supramammary lymphatic glands should be made. If

are those that suffer most, and are those in which the lesions are most fully developed From these glands the disease may spread either in a forward or backward direction, or both, but the former is generally more marked than the latter In exceptionally bad cases nearly every gland in the animal's body may be diseased, as a rule, however, the dissemination is not so great.

In a calf recently seen by the writer the portal glands were extensively involved, there were a few tubercles in the liver, the whole chain of mediastinal glands was affected, and the prescapular on one side showed one or two minute tubercles The disease did not extend farther forward, the suprasternal and glands of the head being normal Posterior to the liver the renal were the only glands affected Such a distribution, beginning at the liver, and extending especially in an anterior but also in a posterior direction, would seem to point very clearly to the infection being brought about by the maternal blood, which, entering by the umbilical vein in the neighbourhood of the liver, flows in an anterior and posterior direction, the greater supply passing forward to the animal's head.

If it be admitted that the maternal blood is the carrier of infection, the next question that arises is, how do the tubercle bacilli gain access to it? We know that many cows suffer from a tuberculous condition of the uterus, which is frequently induced by a tuberculous bull, under these circumstances it is not difficult to understand how the placenta might also become involved. Did a tuberculous process eat its way into one of the placental vessels, the blood supply to the fœtus might very easily become infective

Another very interesting fact, closely associated with this question, is that it is no uncommon thing to find in well-fattened three-year-old bullocks tuberculous lesions in the lymphatic glands, showing a very similar distribution to those found in calves, and the suggestion is that these foci must have lain dormant, without spreading into other organs or parts, during the three years of the animal's life prior to slaughter

the disease is present, they will be enlarged, and, on palpation, small hard tubercles may be felt.

Tuberculous joints are generally typical in appearance; they present a painless swelling or thickening, and are firm to the touch.

Conditions found in the Organs and Carcass

Formation and Appearance of a Tubercle.—When tubercle bacilli gain entrance to the tissues they multiply; their presence stimulates proliferation of the fixed tissue cells and attracts many white corpuscles or leucocytes to the spot. In this way the intruding bacilli become surrounded by cells and leucocytes, whose function it is to destroy or prevent their spread.

Thus the tubercle, from which the disease derives its name, is produced. In the earlier stages it appears as a small semi-transparent grey gelatinous body about the size of a millet seed. The leucocytes may prevail over the bacilli, and after the production of a tubercle the process may come to an end. More frequently, however, the bacilli gain the ascendancy, and, spreading into surrounding parts, give rise to the formation of fresh tubercles.

Larger nodules may be formed by the coalescence of adjacent tubercles, and, by the concurrence of vast numbers in successive generations, large masses may be produced.

Microscopical Appearances.—A tubercle is a small rounded body composed of cells and devoid of blood-vessels. The bacilli may be few in number, and unless the section be specially stained, may escape observation. In the centre of the tubercle a giant cell is generally found; it is a large body containing numerous nuclei situated near the periphery of the cell, while radiating processes may be seen to extend from its poles. The giant cell is, as a rule, surrounded by a layer of epitheloid cells; outside of which is a zone of leucocytes, while a dense fibrous capsule generally surrounds the whole. Thus from within outwards there is: (1) a giant cell (there may be more than one), (2) a layer of epitheloid cells, (3) a zone of leucocytes; and (4) a fibrous capsule.

Degenerative Changes.—As the tubercle is a non-vascular structure, it is prone to degenerative changes produced by the toxins elaborated by the bacilli. Three forms of degeneration are met with: caseation, calcification, and fibrosis.

CASEATION.—Nodules having undergone this process present

a yellowish centre of caseous (cheesy) material, surrounded by a greyish zone of firmer consistence. When caseation is confined to individual nodules, small areas of soft yellow and cheesy appearance (about the size of a pea) are found. The caseous nodules, by joining together, may produce large tuberculous masses. The softening of caseated material, and its expulsion through a bronchial tube, may give rise to the formation of a cavity in the lung; by a similar process an ulcer on a mucous membrane may be produced, or a tuberculous abscess in other organs or parts.

CALCIFICATION is frequently met with in tuberculous lesions in cattle and pigs, and gives rise to a characteristic " gritty " feeling when the affected part is sectioned with a knife. It is one of the modes by which healing takes place, a completely calcified lesion being no longer infective.

FIBROSIS is another method by which a tuberculous process may be healed. It commences at the periphery of the nodule and spreads inwards. Small grey nodules in the lung are sometimes found surrounded by a ring of fibrous tissue.

Local and Generalized Tuberculosis.—It is important to distinguish clearly between local and generalized tuberculosis. The disease is said to be local, or primary, when it is limited to one organ or part, or spreads to another organ or part by contiguity, or through the agency of the lymph stream without the co-operation of the circulation. When tubercle bacilli gain access to the blood stream, and are dispersed throughout the body, giving rise to secondary infections, the disease is said to be " generalized ".

Localized Tuberculosis.—Local, or primary, infections are brought about:—

(1) By inhalation of tubercle bacilli into the lung. (2) By swallowing tubercle bacilli derived from an external source along with food or milk, or by the swallowing of expectorate from a tuberculous process of the animal's own lung (auto- or self-infection).

It follows that primary infections are most commonly found in the respiratory and alimentary tracts. Tubercle bacilli do not, however, always produce a lesion at their point of entry. They may pass through the epithelium of the mucous membrane without injuring it and set up disease in the neighbouring lymphatic glands. The serous membranes may be similarly affected without any lesion being present in the lungs or alimentary tract. Serous tuberculosis may therefore be a primary infection.

The uterus of a cow may be the seat of primary tuberculosis,

the organ being infected through the agency of a tuberculous bull.

Appearance of Primary Lesions.—The tubercles are not very numerous. They exhibit considerable difference in size and stage of development, most of them being larger than millet seeds. Young cattle and pigs generally show primary infection of the alimentary tract, due to being fed upon milk derived from tuberculous cows; whereas in older cattle the lesions are most frequently found in the lung or bronchial glands, caused by the inhalation of tubercle bacilli, to which cows are peculiarly liable owing to their being frequently housed with infected cattle in overcrowded, dark, and insanitary cow-houses.

Generalized Tuberculosis.—The disease may become generalized in one of the following ways:—

The bacilli may gain access to the blood stream by a localized diseased area eroding its way through the walls of a vein and pouring its contents into the circulation. If bacilli enter the lymphatic vessels, the glands act as fortresses against the further invasion of the body. The latter may, however, in time be overcome by the enemy, when, the barrier being removed, the bacilli have a clear passage into the large lymphatic vessels and thence into the blood stream.

APPEARANCES OF SECONDARY INFECTIONS, or those produced when generalization has set in. An abundant crop of minute miliary tubercles about the size of a millet seed are present, which appear as greyish yellow points scattered throughout the substance of the organ. The tubercles are all uniform in size and shape, and are evenly and densely distributed throughout the organ on the course of its capillaries.

Generalized tuberculosis is always secondary to a local lesion. It may, indeed, be looked upon as a tuberculous septicæmia, and its onset is marked in the living animal by definite clinical symptoms, such as high temperature, rapid respiration, and loss of flesh. It is probable that from two to three weeks elapse between the pouring of the bacilli into the blood and the time when miliary tubercles become visible to the naked eye. It is therefore almost impossible for the meat inspector to recognize the true state of affairs in animals killed during that latent period, but were an inspection made during the live state, the animal's appearance would immediately attract the attention of the inspector, and, if large areas of tubercle were found after slaughter, he would have ample reason to suspect that generalization had occurred.

It is said that in heavily milked cows acute miliary tuberculosis

PIG'S LIVER AND SPLEEN, SHOWING TUBERCULOUS FOCI

The lobes of the liver are clearly seen; also the fibrous ridge of attachment on the under surface of the spleen.

(Photo from Mr. H. W. Gill, S.I., Folkestone.)

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frequently follows parturition, the tuberculous process having remained dormant during the period of gestation.

In generalized tuberculosis all organs are not equally affected; some appear to afford a better nutrient medium for the growth of the bacilli than others. Certain tissues seem to have a natural resistance to the disease. The muscles, for example, are seldom or never affected. The organ, or organs, affected may be determined by the point of entrance of the bacilli into the circulatory system. If infection of the blood takes place through the thoracic duct, the bacilli are carried directly to the right heart and thence to the lungs, where a process of filtration takes place, the bacilli being retained in the fine pulmonary capillary network. On the other hand, if the bacilli enter a branch of the portal vein, the liver acts as a filter, and so thoroughly may it perform this function, that it alone may become infected while the remainder of the system escapes. Professor Ostertag, in the Berlin Archives, called attention to the fact that in generalized tuberculosis of bovines a certain sequence of participation of the various organs is to be observed. An infection of the lungs and liver is uniformly found, then follows the spleen and kidneys, the prescapular and inguinal glands, udder, bones, and joints.

When the posterior part of the peritoneum is affected in female animals the uterus is generally also involved.

Diagnosis and Differential Diagnosis.—The conditions most likely to be confused with tuberculosis are:

1. Actinomycosis in the mouth, lungs, bones, and udder.

2. Caseated cysticerci and echinococci in the lungs, liver, spleen, and lymphatic glands.

3. Abscesses in the liver, spleen, lungs, and kidney.

Characteristic Appearances of Tuberculous Lesions.—Professor Ostertag describes the characteristics of tuberculous processes thus:

1. "They are composed of minute tubercles, which at first are perfectly grey and transparent, and later become cloudy in the centre, and finally cloudy throughout.

2. "The presence of minute tubercles around the larger tubercles.

3. "The regular sympathetic affection of the corresponding lymph glands in a typical sequence—first swelling, then formation of tubercles in the glandular tissues, and finally caseation and calcification of these tubercles."

In doubtful cases the diagnosis may be aided by making microscopic preparations and staining by the Ziehl-Nielsen method (p. 150).

ACTINOMYCOTIC LESIONS are generally accompanied by a fibrous proliferation. The corresponding lymphatic glands may become enlarged and œdematous, but do not show nodules which are visible to the naked eye, neither do they suppurate nor undergo caseous degeneration. The actinomycotic parasite may be found in the lesion in the form of pale yellow granules about the size of a millet seed. In cases of difficulty a microscopic examination will confirm the diagnosis.

CASEATED CYSTICERCI AND ECHINOCOCCI.—The corresponding lymphatic glands are not affected, and the caseated contents are easily separated from their capsules.

ABSCESSES.—It is sometimes difficult to distinguish between the miliary abscesses found in pyæmia and generalized tuberculosis. In either case, however, the whole carcass should be condemned, and the differential diagnosis is not therefore a matter of great importance.

The majority of tuberculous-like lesions in the internal organs of the ox are due to the tubercle bacillus. In the sheep, on the other hand, lung tubercles generally owe their origin to parasitic embryos.

ORGANS AND PARTS AFFECTED BY TUBERCULOSIS

In cattle the lungs and pleura are affected in about 40 per cent of the cases; the lungs alone, in 20–25 per cent; the pleura and peritoneum, in 15–20 per cent; and in the remaining cases the lymphatic glands, the genital organs, mammæ, bones, &c. (Nocard).

Respiratory System.—The larynx and trachea seldom show evidences of tuberculosis. The lungs and their glands are the organs most frequently affected in the ox.

The Lungs

MODES OF INFECTION AND MANNER OF LOCAL SPREAD.—When inhaled into the lungs, tubercle bacilli may multiply in an air cell or alveolus, causing a reaction on the part of the tissues with the formation of a tubercle, and thus a primary lesion is produced. From this a gradual direct invasion of the surrounding tissues may take place. Should a bronchial tube become involved, the

CARCASS OF COW SHOWING FAR-ADVANCED TUBERCULOSIS OF PLEURA AND PERITONEUM

The tubercles are well seen. On the pleura on the right-hand side of the engraving they adhere together in clusters forming " grapes " or " tubers " On the left-hand side streaks of lymph exudate make their appearance The udder has not been removed, but is seen hanging on both sides of the carcass

bacilli may be conveyed along with the mucus, through the act of coughing, into other tubes and alveoli far removed from the primary lesion, and there set up fresh centres of disease. Bacilli from the periphery of a primary lesion may enter a lymphatic vessel, and instead of being conveyed direct to a lymphatic gland, may be arrested by leucocytes and give rise to the development of a tubercle. Thus detached lesions may be found in the neighbourhood of a primary lesion along the course of the lymphatics.

It appears probable that bacilli inhaled into a pulmonary alveolus may sometimes, before they have time to multiply, gain entrance to the rootlet of a lymphatic and be conveyed to the bronchial or mediastinal glands. This may be the explanation of those cases in which no tuberculous lesion can be found in the lungs, while the bronchial or mediastinal glands are diseased. The above are examples of local spread, but the lungs may also be infected through the blood stream in generalized tuberculosis.

Pathological Changes.—In local, or primary tuberculosis, small tubercles, larger caseous or calcified nodules, or areas of caseous softening may be found. Perhaps the most frequent lesion is a tuberculous broncho-pneumonia, in which caseous nodules are found, or a large area of lung substance may be converted into a cheesy mass. The condition may go on to cavity formation, when cavities of various sizes with ragged walls, and filled with a fluid watery pus, may be present. It is generally the bases, and not the apices, of the lungs that first become affected with tubercle in bovine animals.

In generalized tuberculosis the tubercle bacilli gain access to the blood stream, and may lodge in the fine capillary network of the lungs, giving rise to "miliary tuberculosis". The organs become studded over with small tubercles about the size of a millet seed, which are uniform in size and shape, and are evenly and densely distributed throughout the organ on the course of its capillaries (see Plate XII). On account of the distribution of the capillaries in the lungs, generalization is more readily recognized in them than in other organs. It should also be borne in mind that an acute miliary tuberculosis may be present with a chronic lesion, and thus the same lung may, at the same time, show a primary tuberculous lesion, and a secondary miliary affection.

Serous Membranes (pleura, peritoneum, and pericardium).

Modes of Infection.—The pleura is most frequently affected by direct extension from a lesion in the lung, or from a diseased

mediastinal or bronchial gland. When the bacilli enter the pleural cavity, the disease may spread laterally through the agency of the lymphatics, or by mechanical dispersion of the bacilli on the pleural surface as a result of respiratory movements. The disease may be transmitted from the visceral to the parietal layer, and spread until the entire pleural surface becomes involved. A tuberculous pleurisy may be found without involvement of the lungs where the bacilli have passed through the pulmonary mucous membrane without having produced any lesion thereon.

The peritoneum may be infected from tuberculous lesions in the intestine from diseased mesenteric glands, or from the pleura by means of the lymphatic vessels which pass through the diaphragm. M'Fadyean believes that peritoneal tuberculosis is always lymphatic in origin, and its presence should therefore not be taken as an indication that generalization has occurred.

The pericardium may be infected by spread of the disease from the pleura.

Pathological Appearances.—*As these are the same in all* serous membranes, one description will serve for pleura, pericardium, and peritoneum. Serous tuberculosis, or " pearl disease ", is frequently found in cattle, but comparatively seldom in pigs.

In the early stages the serous membrane is covered with a slimy, flaky, exudate of a reddish colour. On the pleura or peritoneum this might be mistaken for a non-tuberculous pleurisy or peritonitis. The true nature of the conditions may, however, be determined by examination of the neighbouring lymphatic glands. If they are tuberculous, it may be assumed that the serous membranes are affected in like manner. If the glands show no signs of tuberculosis, it is probable that simple pleurisy or peritonitis is present.

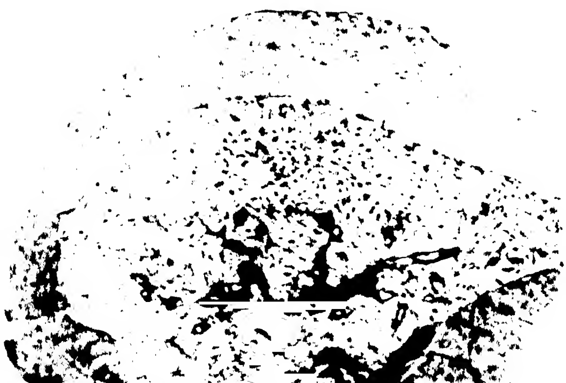
In tuberculosis of the serous membranes, at a later stage, the flaky exudate gives way to the formation of small tubercles, which gradually increase in size, and may become yellow or caseous. Proliferation of connective tissue may unite many tubercles into one mass, forming large greyish or yellow nodules. Many nodules may adhere together in grape-like clusters on the surface of the membrane, giving rise to the condition known as " grapes " or " tubers " (see Plate XI).

Lymphatic Glands are infected by the lymph stream coming from diseased organs or parts (see Plate IX).

Pathological Changes.—(1) Glands become enlarged and œdematous (they may lose their normal bluish-grey colour and become

1

2



3

1, Longitudinal section of tuberculous lymphatic gland
2 Section of tuberculous udder
3 Section of lung showing miliary tuberculosis

pink and congested). (2) Minute grey tubercles appear. (3) The tubercles gradually enlarge and become cloudy in the centre, due to caseation. (4) Calcification generally takes the place of caseation at a later date.

Liver.—Modes of infection. The disease may spread:

(1) from the peritoneal covering of the organ if it be affected with tuberculosis; (2) from the hepatic glands; or (3) through the portal vein.

In severe cases, when infection occurs as in (1) and (2) above, the surface of the organ may be found rough and irregular, being studded over with nodules. On section, tubercles of various sizes, sometimes caseous, sometimes in the form of abscesses with thin capsules, may be found. The latter generally contain a thin watery tuberculous pus of a greenish colour. The hepatic glands may show evidences of tuberculosis without the liver itself being involved.

In generalized tuberculosis, when the liver has become infected through the portal vein, small miliary tubercles will be found throughout the substance of the organ.

Kidney.—In early stages of the disease small grey tubercles are present, frequently arranged in groups due to local dissemination. They are generally spherical and possess caseous centres. The renal lymphatic glands may also show signs of disease. In generalized tuberculosis the kidneys are frequently involved, when miliary tubercles appear as yellow points on the surface and throughout the substance of the organ. They may, however, be few in number, and many sections may require to be made before they are found.

Spleen.—In cattle the spleen is not often infected; when present the disease is most frequently seen in the peritoneal covering of the organ, and occurs as small tubercles. The substance of the spleen is rarely involved. The splenic gland should be examined and is often infiltrated when the organ is diseased. In pigs tuberculosis of the spleen is more common, and the disease manifests itself as nodules of varying sizes in the substance of the organ, the peritoneal covering being less frequently affected than in cattle.

Stomach and Intestines.—Pigs and young cattle may show a primary affection of the alimentary tract and corresponding lymphatic glands, due to ingestion of tuberculous milk. In older cattle a primary lesion of the lungs is common, but a secondary infection of the intestines may take place as a result of the swallowing of mucus laden with tubercle bacilli from the diseased lung. Tuber-

culous lesions of the stomach are very rare; if, however, the organisms escape the action of the gastric juice, they pass into the intestines, where they may give rise to the formation of tuberculous ulcers. Sometimes the bacilli pass directly to the mesenteric lymphatic glands without producing any lesion in the intestine.

Heart and Blood-vessels are seldom affected with tuberculosis.

Sexual Organs.—The uterus may be infected by spread of the disease from the peritoneum. It may also, as already pointed out, be the seat of a primary lesion, and the disease may spread from it directly to the peritoneum, or to the surrounding lymphatic glands.

PATHOLOGICAL CHANGES.—Great thickening of the uterine wall due to tuberculous infiltration may be present. When the uterus is diseased the oviducts are generally likewise affected. If tuberculous, the ovaries become enlarged, fibrous and studded over with tubercles.

The Udder may be infected by the lymph stream from tuberculous peritonitis, or through the agency of the blood.

PATHOLOGICAL APPEARANCES.—The normal mammary tissue is white or yellowish in colour and silky to the touch; the diseased portions are grey, firm, and solid. As a rule only one quarter of the organ is affected, but the whole udder may sometimes show signs of the disease. In the early stages the affected parts are swollen; later, the swelling becomes greater, and a fibrous proliferation takes place. A healthy udder, however large, is uniformly soft to the touch, while the enlarged tuberculous quarters are firm and hard. To establish the diagnosis all such thickenings should be incised. The tubercles, which are occasionally very large, are hard, firm, and of uneven surface; caseation and calcification may be found in the later stages (see Plate XII). The supramammary lymphatic glands should always be examined. If the udder is tuberculous, they are almost invariably involved.

Abscesses in the udder are seldom tuberculous in character.

Testicles.—When tuberculous, these glands become much enlarged and frequently caseous. An animal so affected may transmit the disease to the female and her offspring.

Bones.—The dorsal vertebræ, ribs, and sternum are commonly affected in bovines and pigs. Infection of the bones of the extremities is less common. The mode of infection is probably by the lymph stream.

The vertebræ and sternum, being split in the cutting-up process,

are easily inspected—a tuberculous caries being the most common lesion. The diseased portions are enlarged and show granulations of a greyish-red colour. Later, these take on a more distinct greyish-yellow colour. A thin shell of the normal bony tissue may be all that remains in a far-advanced tuberculous process. In the vertebræ, the spinous processes as well as the bodies are frequently diseased. In the ribs thickenings occur which in the later stages are easily cut through, and may thus be distinguished from callous formation resulting from fracture.

Muscle.—Muscle serum and tissue seem to offer a less favourable medium for the multiplication of tubercle bacilli than the tissue of other organs and parts. Indeed, tuberculosis of the muscles is of very rare occurrence in animals whose flesh is used for the food of man. The disease may, however, extend secondarily to the muscular tissue from diseased bones or lymphatic glands which lie embedded in it, and the author has seen a small focus of tubercle in the intercostal muscles of an ox in the Berlin abattoir; such an occurrence is, however, exceptional. In generalized tuberculosis, the bacilli are in the blood stream, for a period however short, and the muscle serum from animals in this condition has been shown to give rise to tuberculosis in inoculated animals.

Blood.—When the bacilli gain access to the blood stream, they are rapidly eliminated by the filtering action of the various capillary networks. If the bacilli enter the right heart, they are filtered by the capillaries of the lungs, which will, in consequence, show the most abundant tuberculous changes. If, on the other hand, they enter the portal vein, the liver, acting as the filter, becomes itself chiefly affected. Nocard and M'Fadyean have shown that the blood generally loses its virulence in from four to twenty-four hours; the latter, however, has demonstrated that it may soon become virulent again owing to a fresh eruption of bacilli.

Judgment.—Full directions are contained in Memo. 62, Foods, Section III, for the examination of carcasses and viscera where tuberculosis has been detected, and in Section IV the action to be taken is also fully set out; no further discussion is therefore needed.

CHARACTERISTICS OF TUBERCULOSIS IN SWINE

(*a*) Generalized tuberculosis is more frequent than in cattle.

(*b*) Bones and joints are commonly affected.

(*c*) Disease is frequently present in the distal glands of the hog carcass.

(*d*) The submaxillary gland is very frequently affected.

(*e*) The lungs, pleuræ, and peritoneum are much less often diseased in swine than in cattle.

(*f*) Tuberculous disease of the spleen is rare in cattle, more common in pigs, and in the latter animal the splenic substance is affected rather than the peritoneal surface.

(*g*) The mammary gland of the pig is much less often diseased than is the udder of the cow.

(*h*) Tuberculosis is more common in young pigs than in calves.

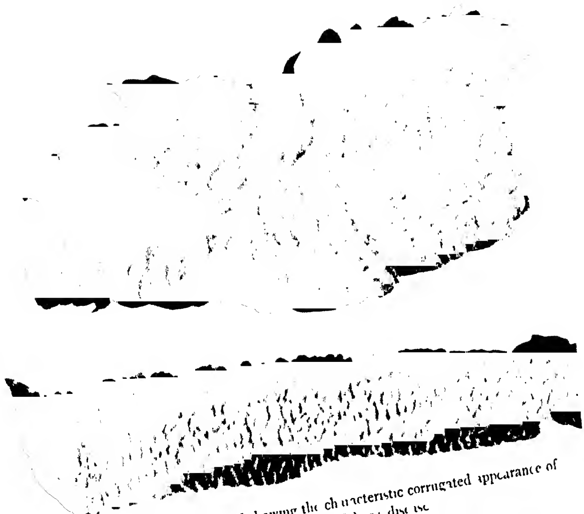
JOHNE'S DISEASE OR PARATUBERCULOSIS

Johne's disease may be defined as a chronic specific enteritis affecting cattle and, more rarely, sheep, goats, and even horses; swine are immune. It is caused by Johne's bacillus, which multiplies in the intestinal mucous membrane and mesenteric glands, producing a diffuse thickening of the bowel which interferes with the absorption of food and leads to diarrhœa and wasting.

The characteristic lesions are found in the intestine. The ileocæcal valve and the last part of the ileum generally show the most marked lesions, but the condition may also occur in the large intestine. Sometimes the small intestine escapes and the lesions are found only in parts of the large intestine. The gut should be cut open longitudinally for purposes of examination. There is marked thickening of the diseased portion of bowel, and the mucous membrane is thrown into characteristic corrugations which do not disappear however much the bowel is stretched (see Plate XIII). The mesenteric glands adjacent to the lesion are usually enlarged and œdematous, and on section a watery fluid exudes.

"Johne's bacillus" is an acid-fast organism morphologically indistinguishable from the tubercle bacillus. It is stated that this micro-organism does not grow on any of the ordinary culture media, but certain workers claim to have cultivated it on media containing

PLATE XIII



Pieces of intestine slit open and showing the characteristic corrugated appearance of the mucous membrane in Johne's disease

INTESTINE AFFECTED WITH JOHNE'S DISEASE

NORMAL INTESTINE

Facing p. 102

dead acid-fast bacilli, glycerine extracts of such bacilli, or the products of their growth.

Judgment.—In the early stages, when the intestines only are affected, condemnation of the affected parts is sufficient (62, Foods, Sec. V *B*). In the later stages there is general pathological emaciation and the entire carcass and all the organs should be condemned (62, Foods, Sec. V *A* 10).

CASEOUS LYMPHADENITIS OR PSEUDO-TUBERCULOSIS

Caseous lymphadenitis is a disease which occurs in sheep all over the world, and which was formerly known as pseudo-tuberculosis. The examination of imported mutton has shown it to be common in South America, Australia, and New Zealand. It is known also in the United States and in parts of Europe, including Germany, France, and Great Britain. Horses are not uncommonly affected by a condition known as ulcerative lymphangitis due to the same organism, the Preisz-Nocard bacillus. The occurrence of caseous lymphadenitis in cattle and pigs does not appear to have been definitely confirmed.

BACTERIOLOGY.—The Preisz-Nocard bacillus is a slender, non-motile, non-sporing, Gram-positive, diphtheroid organism frequently showing several forms. Though inoculation of cultures may produce an acutely fatal condition the natural disease is usually chronic in type, and the general health and nutrition of affected sheep are not seriously impaired. It is probable, however, that many animals die from the disease, but that the symptoms are not recognized as being due to infection with the Preisz-Nocard bacillus.

SITE OF LESIONS.—In sheep which come to slaughter, lesions are most common in the carcass lymph glands, particularly the prescapular, precrural, superficial inguinal and popliteal, but they are also frequent in the lungs and in the bronchial and mediastinal glands. The abdominal organs are much less affected, but lesions are found in the liver, spleen, kidney, and associated glands. Other sites in which the disease is found are the skin and subcutaneous tissue, the bones, and the serous membranes.

APPEARANCE OF LESIONS.—In a lymphatic gland the disease causes first some general enlargement, followed by the development of a focus of caseation which increases in size and may ulti-

mately break down into a thick greenish pus or dry up leaving a typical laminated structure resembling an onion in section. Some degree of calcification may occur, but this is not so marked as in tuberculous lesions. Whether caseous or purulent, the lesions are surrounded by a definite fibrous capsule.

In the lungs, acute, subacute, and chronic lesions are described. An acute pleuro-pneumonic condition, multiple abscesses, or large cheesy encapsulated tumours may be found. In the liver, spleen, and kidney multiple abscesses varying in size from a small pea to a walnut, encapsulated and containing the typical greenish caseous or purulent material, occur.

Mode of Infection.—Experimentally the disease has been communicated by ingestion of cultures of the Preisz-Nocard bacillus, and it would also appear that infection may occur by inhalation. But it seems probable that in most cases infection takes place by the inoculation of small wounds, and that the lesions of internal organs are the result of the bacilli having gained access to the blood stream via the lymphatics. There are many possibilities of infection of small wounds, particularly in shearing. If a sheep has a discharging caseous lymphadenitis abscess, or if such an abscess is ruptured during shearing, the shears and the clothes of the shearer become contaminated. The infection may therefore easily be conveyed to sheep shorn subsequently, as numerous small wounds are inevitably caused during shearing, particularly with mechanical clippers. For the same reason the floors of shearing sheds become contaminated; if the operations of castration and docking are carried out in these places there is opportunity for infection of the wound.

This view of the usual method of infection is supported by the fact that the percentage of sheep infected appears to increase rapidly as age advances. Involvement of the internal organs is much more common in the older sheep.

Administrative Action.—There is no record of caseous lymphadenitis or any comparable pathological condition occurring in man. It is, however, recommended by the Ministry of Health that if a carcass of mutton shows any evidence of caseous lymphadenitis the whole carcass and all the organs should be condemned. (Memo. 62, Foods, Sec. V *A* 17.)

A very careful inspection of imported mutton has been carried out in this country during recent years and a large number of carcasses have been condemned. In consequence, the meat exporters in South America, Australia, and New Zealand have instituted a routine

examination for caseous lymphadenitis at the time of slaughter. This examination includes actual incision of the prescapular, precrural, and superficial inguinal glands, diagnosis by palpation having been found unsatisfactory. As a result there has been a very great improvement, as regards caseous lymphadenitis, in the condition of mutton arriving in this country, but a percentage of all imported carcasses is still examined on arrival. Any found infected or with lymphatic glands missing are condemned, and the examination is extended whenever routine sampling suggests an imperfect standard of inspection in the country of origin.

CHAPTER IV

Other Bacterial Diseases of Known Origin

Anthrax—Bacilliary Necrosis—Black Leg or Black Quarter—Louping Ill — Braxy — Glanders — Swine Erysipelas — Malignant Œdema—Tetanus—Actino-bacillosis.

ANTHRAX

Anthrax, splenic fever, splenic apoplexy, or " staggers ", as it is sometimes called by butchers, is a disease of animals caused by a rod-shaped organism, the *Bacillus anthracis*, which is present in the blood. The disease also occurs in man, when it is known as malignant pustule, or " Woolsorters' Disease ".

Anthrax occurs in cattle, sheep, and horses, but rarely in pigs, young cattle being peculiarly prone to attack. The malady often runs a rapid course and death may occur within forty-eight hours of the onset of illness.

Infection is brought about by the introduction of the bacillus, or its spores, into the blood. Feeding stuffs, such as oil-cake or cotton cake, or manures made from animal substances, may be vehicles of infection. The disease may also be transmitted to animals through drinking water contaminated by factories where hair and hides are used. The bacillus may enter the body through wounds (thus frequently infecting young animals during the process of the eruption of the teeth when the gums are broken), or, if spores are swallowed, along with food or drink, they may pass through the lymph follicles or through minute defects in the intestinal walls and thus give rise to infection.

Symptoms.—In cattle the onset is generally sudden, there being excitement often accompanied by bellowing. In sheep the disease may manifest itself by a sudden apoplectic seizure, or gnashing of the teeth, staggering, and trembling. When the onset is less acute, the animal stands, if possible by itself, with drooping head and shows no disposition to move or feed. The temperature is raised,

there is a rapid feeble pulse, and the breathing is accelerated. If made to move, the gait is staggering, as though the animal were giddy, and the muscles twitch and quiver. There may be discharge of saliva from the mouth. The dung often contains blood and the urine is sometimes red from a similar cause. Bleeding from the nose and anus not infrequently occurs.

Post-mortem Appearances.—The most characteristic feature is the great enlargement of the spleen, which may be two or three times its normal size. It is dark red in colour, and, on section, the pulp is soft, friable, and resembles tar. The organ is sometimes found ruptured on opening the abdomen.

The liver is large, congested, and may show cloudy swelling. The intestines are inflamed and contain dark partially clotted blood. The lymphatic glands, particularly the mediastinal, mesenteric, and cervical, are enlarged and congested, while the lymphatics may be swollen. Ecchymoses are common on the pleura and peritoneum. The flesh is rather paler than normal except in the hæmorrhagic areas which are blackish red in colour. The blood is dark and tarry looking.

As already stated, pigs rarely contract the disease, but, when infected, their throats become very much swollen and there are internal hæmorrhages, though the spleen may not be enlarged.

Diagnosis.—An enlarged spleen and rod-like bacilli in the blood may be found in malignant œdema and black leg. Further, in red water fever the spleen is very much enlarged, but in anthrax the substance of the organ is much more " tarry " than in red water fever. In all suspicious cases blood should be taken from the ear or spleen and subjected to microscopic examination, when large non-motile rod-like organisms occurring in short chains may be distinguished. In specimens obtained direct from the blood or spleen, the square ends of the bacilli appear broader than the body, while, if suitably stained, each organism is seen to be surrounded by a gelatinous capsule. The cadaver bacillus (or malignant œdema bacillus) sometimes found in the blood and tissues of animals that have lain unopened for some time, must not be mistaken for that of anthrax. The former is longer and more slender, has rounded instead of square ends, and has no capsule. Further, the cadaver bacillus forms spores in the carcass, whereas the anthrax bacillus only forms spores outside the body, i.e. in the presence of oxygen.

Procedure to be adopted when dealing with Anthrax.—Under the Contagious Diseases of Animals Acts and Orders, it is the duty of

every person having, or having had, in his possession, or under his charge, an animal affected with or suspected of anthrax to give notice of the fact with all practicable speed to the police. On receiving such notice the Local Authority shall institute inquiries, with the assistance and advice of a veterinary inspector, and make proper provision for the disposal of the carcass and for the disinfection of the premises upon which disease had existed or is suspected to have existed.

In every case of sudden or unaccountable death among stock, anthrax should be suspected. The sick animal must not be killed, but should be carefully isolated from all other animals. Should the affected animal die, the carcass should not be cut, or opened, as the blood contains large numbers of bacilli which need oxygen for their growth, and which, if exposed to the air, may produce spores and be the means of infecting other animals at short or long intervals. The bacilli of anthrax die if kept within the intact carcass. Persons engaged in slaughtering ailing animals or in dressing or handling the carcasses or hides of diseased animals are liable to contract anthrax.

If an animal is sent to a slaughter-house in a dying condition, or if death has taken place during transit thither, the possibility of anthrax should be suspected. If an enlarged spleen is found on opening a carcass, the further skinning and dressing of the animal should be prohibited and work in that part of the slaughter-house where the suspected animal was killed should be suspended until a diagnosis has been made. Should the disease prove to be anthrax, all knives and other instruments used in connexion with the animal must be boiled, and the premises cleansed and disinfected by the Local Authority in accordance with the provisions of the Anthrax Order, 1928.

Disposal of the Carcass.—It is the duty of the Local Authority to dispose of the carcass, which is best effected by exposure to a high temperature, or, where that is impracticable, the carcass may be buried in its skin in a suitable place to which animals will not have access and which is removed from any dwelling-house, and at such a distance from any well or water-course as will preclude the risk of contaminating the water therein, the carcass being buried at a depth of not less than six feet below the surface and with a layer of lime not less than one foot deep both beneath and above it.

Judgment.—The carcass and all the organs shall be condemned if evidence of anthrax is found. (Memo. 62, Foods, Sec. V *A* 3.)

BACILLIARY NECROSIS

Bacilliary necrosis, a condition found chiefly in the livers of cattle, is due to the necrosis bacillus, which, on microscopic examina-

tion, may be seen on the border between the healthy and necrotic tissue. Numerous necrotic areas, somewhat circular in outline, are generally present. They are of a pale yellow or brownish colour, firm to the touch, due to coagulation of the cell albumen, and more or less clearly differentiated from the surrounding tissue. Livers affected with bacilliary necrosis may be enlarged and their tissue discoloured, or no other change than that of multiple necrosis may be present. Fibrous capsules may form round the necrotic areas; the latter may break down and become purulent, the pus being of a greenish colour.

Judgment.—It frequently happens that bacilliary necrosis is found in the liver of animals in very good condition. When present, the organ should always be condemned, but the rest of the carcass may be admitted to the market. (62, Foods, Sec. V *B*.)

BLACK QUARTER: BLACK LEG

This disease, also known as *murrain*, *quarter ill*, and *black spauld* in Scotland, is brought about by the entrance into the tissues of the Black Quarter bacillus. It chiefly attacks young cattle, but may be found in sheep and goats. The disease cannot be diagnosed until the characteristic swelling appears. The animal ceases to eat, and has a staring coat. Later, lameness, stiffness, and arching of the back appear, and swelling of the leg, loin, shoulder, buttocks, and neck. The swellings crackle on being touched. The animal becomes feeble and dies.

In sheep the disease is more rapidly fatal; the animal may fall dead before illness is suspected, or may stand with its back arched and feet stiffly planted. Swellings on the upper parts of the limbs appear which contain gas in the later stages.

On cutting into such lesions gas escapes. The tissues are infiltrated with a bloody serum, and the muscles of the affected parts are dark red in colour. A rancid odour is given off, which is increased on warming the diseased portions. The flesh tends to putrefy. The disease is seldom seen in the abattoir, and is not communicable to man.

Judgment.—The carcass and all the organs shall be condemned. (Memo. 62, Foods, Sec. V *A* 4.)

LOUPING ILL, OR TREMBLES

Louping ill, or trembles, is seldom seen in England, but prevails largely throughout Scotland, particularly in certain districts. Outbreaks are often confined to small areas. In some parts it is said to be " circumscribed by the windings of a river, and without any ostensible cause, or it is fatal on one slope (south) of a hill, while the opposite escapes; or, again, it prevails on the richest tablelands " (Ministry of Agriculture's Report).

It is a disease of sheep, and is most prevalent in the spring of the year. It was investigated by a Departmental Committee of the Ministry of Agriculture, and it is from their report that the following extracts are taken.

The symptoms are ushered in with dullness and reeling gait, to be followed by choreic spasms or tetanus-like rigidity, and terminating in more or less complete paralysis of the extremities. The duration of the ailment is usually from one to five or six weeks, but some cases terminate acutely in from three to four days.

The mortality in badly infected districts runs from 10 to 50 per cent, and is always highest when sheep are shifted from clean to foul pastures. The carcass, apart from the development of gas in the abdomen, does not, as a rule, present any striking abnormality, a few punctiform hæmorrhages along the course of the intestine being almost the only recognizable tissue lesion. The peritoneal liquid, however, in a large number of instances is fairly abundant, and either presents a turbid appearance or is perfectly clear and apparently unaltered. A rod-shaped organism is found in the intestine and peritoneal liquid, which is the cause of the disease.

Judgment.—In the early stages of the disease the flesh may be little altered; later, it becomes emaciated and œdematous. The entire carcass and all the organs should be condemned if there is evidence of general dropsy or general pathological emaciation. (Memo. 62, Foods, Sec. V *A* 9 and 10.)

BRAXY

This disease, which is seldom met with in the abattoir, is caused by the *Bacillus gastromycosis ovis*.

Symptoms.—The first indications of the malady are: great excitement, a staggering gait, rapid breathing, and staring, bloodshot

eyes. The urine is discoloured, constipation or diarrhœa may be present, and sometimes the paunch becomes distended with gas, or gas is found beneath the skin, giving rise to swelling of the body and a crackling sensation when the part is touched. Ultimately the animal is unable to stand, and lies on the ground, struggling, moaning, and grinding its teeth, until it succumbs to nervous exhaustion.

Braxy was investigated by a Departmental Committee of the Ministry of Agriculture. A few extracts are taken from their report.

"The disease prevails over a large part of Scotland and to a lesser degree throughout the north of England. It also occurs all along the west coast of Ireland. Iceland, the Faroe Isles, and the west coast of Norway are great centres of the disease. Like louping ill, it is a seasonal disease, the late autumn and early winter months being those in which it prevails. Its mortality on the west of Scotland is enormous, but its proportions are exaggerated owing to the fact that at least three other diseases prevail in the braxy districts at approximately the same time of year, and are included with it. We imagine—though further observation would be necessary to establish this—that two of these braxy-like diseases have never till now been recognized. For the time being we have designated them diseases A and B. The third, we presume, although we are not convinced of this, is what is usually termed malignant œdema. Each is caused by a specific bacillus. Disease A prevails mostly in the autumn months, and dies off towards the middle of December. Disease B shows itself towards the end of October or first fortnight of November, and runs into the month of January, while what we have termed malignant œdema occurs all through the autumn, winter, and early spring months. True braxy, on the other hand, is commonest during December and January, and ceases—exceptional cases excluded—by the middle of February. The occurrence of those three other diseases has rendered the subject of braxy in the general acceptance of the term very complicated.

"As in the case of louping ill, the bacilli of braxy, as well as the bacilli of the three diseases associated with it, are probably all primarily intestinal, and kill the animal by getting into the peritoneal cavity and blood. In animals dying from any of them, the peritoneal liquid swarms with the specific organisms.

"The carcass in true braxy becomes rapidly blown up with gas, which accumulates mostly in the peritoneal cavity. The flesh is much blood-stained, and the peritoneal liquid abundant, extremely opaque, and, like the tissues, coloured with liberated blood-pigment. The odour of the whole carcass is remarkable, and differs from that of ordinary putrefaction. It is not peculiar, however, to braxy, but is also recognizable in disease A, as well as in some instances of malignant œdema."

Judgment.—Braxy mutton is consumed frequently by farmers and farm labourers in the Highlands of Scotland. It is frequently dried and salted, and is considered by many a delicacy. It is popularly supposed to give rise to disorders of the bowels when taken in large quantity. Braxy mutton putrefies rapidly, and should in all cases be condemned as unfit for human food.

GLANDERS

Glanders is produced by the introduction of the *Bacillus mallei* into the tissues. It is a disease confined almost exclusively to horses and equine animals; cattle and pigs are practically immune, but man may contract the disease. The malady is of secondary importance in a country where horse-flesh is seldom used as an article of diet, but the inspector must be cognizant of its signs and symptoms, as carcasses for export have to be certified as free from the disease, and quarters of animals sent from abroad must bear a certificate to the effect that the animals have been found free from glanders on ante- and post-mortem examination. Glanders may be acute or chronic.

Acute Glanders.—In this form there are initial rigors, shivering, the temperature is high and the pulse rapid. These symptoms are followed by muco-purulent discharge from the nose, with the formation of nodes or swellings on the nasal mucous membrane. Breathing becomes difficult, diarrhœa sets in, and the animal dies.

There are two varicties of the chronic disease: (1) chronic glanders, and (2) farcy.

Chronic Glanders.—In this form are found papules, rather smaller than a pea, situated on the mucous membrane of the nasal septum. Sometimes groups of papules merge into one another; they generally break down, giving rise to ulcers. The glands in the neighbourhood frequently swell, becoming hard and later fibrous. A discharge from the nostrils is frequent and very contagious. Of the internal organs the lungs are most often affected, while the trachea and bronchi may show ulceration.

Farcy is characterized by the appearance of buds and nodules in and beneath the skin, especially at the root of the tail and over the limbs. The lymphatic glands may become affected and the limbs swollen. The nodules generally break down, discharge pus, and are converted into ulcers.

DIAGNOSIS.—A disease known as " lymphangitis " occurs in the horse and may be mistaken for glanders. It is caused by the *Streptococcus parsinomonis*, which gains entrance through wounds and abrasions and forms nodules which ulcerate. The lesions are less confined to the limbs than in farcy, and may occur on any part, including the nostrils, lungs, air passages and glands. Microscopic examination will distinguish the conditions, while the " mallein test " (a fixation test) will be negative if the disease is not glanders.

Under the Glanders and Farcy Order of 1929, it is the duty of every person having, or having had, in his possession, or under his charge, any diseased or suspected horse, ass or mule, to give immediate notice of the fact to a police constable. The duty also applies to every person licensed to slaughter horses in respect of a carcass of any diseased or suspected horse, ass or mule in his possession.

Under the same Order, any veterinary surgeon who in his private practice is employed to examine a horse, ass or mule, or the carcass of such animal, and is of opinion that the animal is diseased, or was diseased when it died or was slaughtered, or suspects the existence of disease therein, shall with all practicable speed give notice of the existence or suspected existence of disease to an inspector of the Local Authority for the purpose of the Diseases of Animals Acts.

Judgment.—The duties of the inspector are pointed out in Memo. 62, Foods. The carcass and all the organs should be condemned if evidence of glanders or farcy is found. (Memo. 62, Foods, Sec. V *A* 14.)

MALIGNANT ŒDEMA

Malignant œdema seldom occurs in animals. It is due to a slender bacillus, the *Bacillus œdematis maligni*. When it is found, there is œdema and emphysema of the subcutaneous tissues accompanied by gangrene. The spleen may be slightly enlarged. The meat is not so dark in colour as in black leg. The carcass generally presents the appearance of fevered flesh, and should in all cases be condemned along with all the organs. (Memo. 62, Foods, Sec. V *A* 12.)

SWINE ERYSIPELAS

This disease is due to the *Bacillus erysipelatis suis* and infects swine of over four to six months. Three types have been described: (1) diamond skin disease, (2) acute erysipelas, and (3) chronic cases.

Diamond Skin or Urticaria.—The animal is out of sorts for a day or two, and thereafter an eruption appears; the skin of the chest, neck, outside of the thighs and the back becomes reddish violet in areas either rounded or, more frequently, diamond in shape. These are brought about by minute hæmorrhages which as a rule gradually disappear, but the skin may be shed. The lungs may be inflamed, also the intestinal mucous membrane. The animal generally recovers in about ten days.

Acute Erysipelas.—The animal becomes fevered, shivers, and vomits, and is constipated, and later diarrhœa sets in. A dusky rash appears on the ears, snout, and hocks, and spreads over the whole body. Death is frequently rapid.

Rigor mortis is slight or absent (Hartwig) and decomposition sets in rapidly. The spleen and liver are enlarged; lymphatic glands are large and hæmorrhagic, and the intestinal mucous membrane is swollen.

Chronic Cases.—Animals may recover from the acute stage, but remain "unthrifty" for long—they may show lameness and enlargement of joints. Post-mortem there is evidence of inflammatory changes in the organs, especially the heart and kidneys. Valvular endocarditis with vegetations is generally present, and the kidneys are small and dark.

Judgment.—Where there is evidence of acute swine erysipelas the entire carcass and all the organs must be condemned. (Memo. 62, Foods, Sec. V *A* 11.)

The disease is not communicable to man and in the early stages the flesh is generally passed.

TETANUS

Tetanus, or "lock-jaw", is caused by a specific organism, the tetanus bacillus, which exists in soil and is communicated to animals by inoculation through abrasions and wounds. The bacillus is anærobic, and has spores, giving it a characteristic appearance of a pin with a large head.

All domestic animals and also man are susceptible, but the horse is most frequently the subject of the disease. Sheep may become infected after docking or castration, young lambs through the navel, and cows sometimes become infected after parturition.

Symptoms.—The symptoms are those of stiffening and spasm

ULCERATION OF THE BOWEL IN SWINE FEVER

(Photo supplied by Mr Brennan De Vine, F R C.V.S , City of Birmingham Veterinary Department)

CARCASS OF PIG SHOWING "DIAMOND DISEASE"

(Photo by Mr. H. W. Gill, Folkestone)

caused by the toxin. The muscles gradually become stiff and rigid, the animal appears to be frightened, sweats profusely, and the neck muscles stand out like boards.

Post-mortem Appearances.—Tetanus can only be diagnosed with certainty by a bacteriological examination. In advanced cases small hæmorrhages and hyaline degeneration may be found in the flesh. Kitasato found that the tetanus toxin was destroyed by a temperature of 65° C. for five minutes.

Judgment.—Cooked flesh is probably harmless; but if there is evidence of the disease, the carcass and all the organs must be condemned. (Memo. 62, Foods, Sec. V *A* 31.)

ACTINOBACILLOSIS

A bacillus described by Lignières and Spitz called the actinobacillus is responsible for causing a disease which is clinically indistinguishable from actinomycosis. The organism has been demonstrated in the granulomatous tissue of lesions in cattle from England and the Argentine.

As a result of the examination of the heads of forty home-killed oxen, forty-six frozen tongues and lingual lymphatic glands from Argentina, two from North America, and two from Siberia, all of which were affected with actinobacillosis, Dr. Griffith concluded that the disease is widespread throughout the world, and that a considerable proportion of the cases of the disease in oxen known in this country under the general name of actinomycosis are in reality cases of actinobacillosis. In four cases, however, in which the disease affected the lower jaw (" lumpy jaw "), Dr. Griffith showed that the condition was true actinomycosis.[1]

For signs, symptoms, and diagnosis, see Actinomycosis (p. 123).

[1] *A Preliminary Report on the Pathology of Bovine Actinomycosis*, by F. Griffith, M.B. (Food Report No. 23) issued by the L.G.B., 1915.

CHAPTER V

Diseases due to Filterable Viruses, Unidentified Organisms, and Fungi

Foot-and-mouth Disease—Rabies—Swine Fever—Cattle Plague—Contagious Pleuro-pneumonia of Cattle—Malignant Catarrh of Cattle—Actinomycosis—Aspergillus Pneumonia.

FOOT-AND-MOUTH DISEASE

This is an infectious disease caused by a virus which is filterable and can pass through the pores of a bacterial filter, and is too small to be visible under the microscope. It affects practically all domestic animals and is communicable to man. The incubation period is usually from two to three days.

The parts affected are: the mucous membrane of the mouth, especially the toothless upper jaw, and the tip and sides of the tongue; the nasal septum; the cleft of the hoofs, the coronet, and the base of the supernumerary digits. In the cow, the skin of the udder and the teats may be attacked. Occasionally the mucous membrane of the respiratory or alimentary tracts are involved.

The virus is contained in the discharges from the vesicles in the feet, mouth, and udder of cows. These discharges remain infective for considerable periods of time after leaving the sick animal, and thus the disease may be spread by hay, straw, manure, &c.

The virus enters the body through the mucous membranes; probably the most common method of infection is by way of the alimentary tract.

SYMPTOMS.—Shivering, a staring coat, and rise of temperature. Later, a peculiar sucking noise from the mouth, and discharge of ropy saliva, accompanied by a restless condition of the feet, which are shaken from time to time, as though to dislodge some offending matter. Blisters are found on the heels, along the junction between the hair and hoof, or in the cleft of the foot, and on the lips and

tongue. These break and leave behind superficial sores. In milk cows the eruption may appear on the udder and teats; in sheep the feet only are affected as a rule; whilst in pigs the eruption appears mostly on the snout and feet.

LESIONS.—At first the part appears red and swollen; vesicles about the size of a penny and filled with a clear fluid next make their appearance. These burst readily, leaving behind red sores partially concealed from view by the thin white remains of the membrane. Suppuration is often present. In the mouth the lesions may somewhat resemble actinomycosis. In the latter disease, however, vesicles are always absent. Foot rot in sheep might also be mistaken for foot-and-mouth disease. The former consists of an inflammation of the soft parts of the foot and may lead to sloughing of the hoof. A thick cheesy-looking material often collects over the affected part.

Foot-and-mouth disease is very rarely seen in the abattoirs of this country, because the regulations of the Ministry of Agriculture prohibit infected animals being moved from place to place.

Judgment.—Foot-and-mouth disease is transmissible to man. The flesh of animals suffering from it has, however, frequently been eaten without any apparent ill effects. In the later stages of the disease septicæmia may set in and render the flesh unfit for food. In an outbreak of meat poisoning at Corres, five families became ill after eating the meat of a cow which had been subjected to emergency slaughter on account of the sequelæ of foot-and-mouth disease. The duties of the inspector are set out in Memo. 62, Foods, both as regards notification and condemnation of the carcass when there is evidence of foot-and-mouth disease, and a footnote is appended. (Memo. 62, Foods, *A* and Sec. V *A* 13, and footnote 3.)

RABIES

Rabies is a notifiable disease which is believed to be caused by a virus which has not yet been demonstrated. Under the Rabies Order, 1919, the occurrence of the disease must be notified to the police, who must inform the Ministry of Agriculture and the veterinary inspector of the Local Authority.

All domestic animals are susceptible, but the condition is most common in the dog. In man the disease is known as hydrophobia. Infection is by bite, or from saliva infecting a wound or abrasion. The incubation period is long, usually from five to six weeks.

SYMPTOMS.—There is salivation, and in the initial stages excitement; the animal rushes about and may attack others; dogs bark, snap, and bite at everything. In the later stages the animal becomes paralysed. (In the rabbit the disease is always characterized by paralysis.)

POST-MORTEM.—Apart from the presence of negri bodies in the brain, there is nothing characteristic in the organs; early putrefaction takes place, foreign bodies such as wool, cloth, &c., may be present in the stomach.

The virus gives rise to negri bodies which develop in the nerve cells of the brain, by means of which the disease may be recognized in the dead animal. The diagnosis may be confirmed through rabbit inoculation. The disease is rare in this country owing to the operation of the Importation of Dogs (Amendment) Order, 1918, which requires quarantine of imported dogs for a period of six weeks.

Judgment.—The carcass should be condemned.

SWINE FEVER

This disease is also known as hog cholera, pig typhoid, or enteric; the names " red soldier " or " purples " are also occasionally applied to it. Young pigs are most susceptible. It is caused by a filterable virus, but a bacillus of the Salmonella group is responsible for some of the secondary changes.

SYMPTOMS.—The incubation period varies from four to eight days, after which there is a rise of temperature, the skin becomes reddened and scurfy, especially about the ears, the under surface of the forelimbs, the thighs, and over the breast and belly. Sometimes blisters and scabs appear on the skin. The stricken animals stand with their backs up and their tails depressed; diarrhœa sets in, the abdomen is tucked up, and the legs are drawn up under the body. If the lungs become involved, as they frequently do, there is cough and difficulty of breathing. Ultimately the animal becomes stupid, giddy, or even delirious, and paralysis ends the scene.

LESIONS.—The chief manifestations of the disease are: an eruption on the skin, the formation of ulcers in the alimentary canal, and consolidation of the lungs (see p. 79).

A bluish red discolouration of the skin on the hocks, ears, and under surface of the abdomen is very characteristic. This discolouration is not confined to the skin, but often extends to the fat beneath. Areas of congestion, of a light or deep red colour, are generally found on the mucous membrane of the intestines, while that of the mouth,

pharynx, and stomach may be covered with a well-marked exudate. The most characteristic lesion is, however, the swine-fever ulcer. These occur for the most part on the cæcum in the neighbourhood of the ileo-cæcal valve, but may also be found in the colon and rectum. Such ulcers, which vary in size from that of a pea to a shilling or larger, begin as small necrotic patches. The dead necrosed tissue is afterwards cast off, leaving an ulcer beneath. On healing, the ulcers are converted into cicatrices. The mesenteric lymphatic glands become swollen and congested (strawberry glands), and may show caseous changes—they do not, however, become calcified as do tuberculous glands. Another point of distinction is that, where the glands are only partly caseous, the remainder of the glandular tissue in swine fever is more or less normal, whereas in tuberculosis small tubercles can generally be detected.

The lungs may be unaffected, but are often consolidated, and the pleura may be inflamed. The liver, spleen, and kidneys may be normal, but frequently show small hæmorrhages and necrotic areas.

While the diagnosis of an isolated case may be difficult, swine fever is generally readily recognized in the presence of an outbreak. Insanitary piggeries are the most potent factor in the occurrence and spread of the disease. Reconstruction of pig houses provided with concrete floors, well-paved yards, and a good system of drainage are the best preventive measures.

Judgment.—The disease is notifiable under the Diseases of Animals Acts and Orders (Memo. 62, Foods, *A*), and the carcass and all the organs should be condemned if there is evidence of swine fever. (Memo. 62, Foods, Sec. V *A* 30 and footnote.)

CATTLE PLAGUE OR RINDERPEST

Cattle plague or rinderpest is an infectious fever caused by an organism which has not yet been isolated. Oxen are most frequently attacked. The disease has fortunately been stamped out in Britain.

Lesions.—The mucous membrane of the lips, fauces, and of the first three stomachs may show coagulated areas. In the small intestine swelling and congestion of the solitary glands and Peyer's patches are found, while the mucous membrane is swollen and congested. So-called "zebra markings" may appear in the rectum, due to redness of the mucous membrane covered over by stripes of grey exudate.

The kidneys may be congested; the liver is generally swollen and its surface dull. The flesh in the later stages of the disease may be very dark in colour.

Judgment.—The meat of all animals suffering from this disease must be destroyed. Under the Diseases of Animals Acts the condition of cattle plague is notifiable. (Memo. 62, Foods, *A*.)

CONTAGIOUS PLEURO-PNEUMONIA OF CATTLE

This disease is now very seldom met with in this country. It is caused by a minute organism which can only be demonstrated under very high magnification and which passes through most filters.

Symptoms.—The chief symptoms are hurried and difficult breathing, which may be accompanied by a deep grunting sound, coughing, and rise of temperature. In the later stages the animal stands with its mouth open and tongue protruding, and breathes in a laboured and gasping manner.

Post-mortem.—The most characteristic change is found on sectioning the lung, when the interlobular septa are seen to be greatly thickened, and thrombosis of the lymphatic and blood-vessels is present. The lobules are consolidated and sink in water. They present different colours according to the stage of hepatization reached; thus bright red, greyish, and bluish red lobules may all be seen. The pleuræ are affected by fibrinous pleuritis; they are thickened, have lost their lustre, and their surface is covered by a yellowish exudate. The disease is generally restricted to one lung, the left being most frequently affected (Ostertag).

Judgment.—When this disease is typically present the carcass should be condemned. Under the Diseases of Animals Acts the condition is notifiable. (Memo. 62, Foods, *A*.)

MALIGNANT CATARRH OF CATTLE

Malignant catarrh of cattle is probably bacterial in origin, but the organism has not been identified. The condition is sometimes found in animals after a sea voyage.

Lesions.—The affection of the eyes is characteristic. There is well-marked inflammation of the lids, conjunctivæ, and cornea, causing these parts to assume a red and swollen appearance, while hæmorrhages sometimes occur into the anterior chamber. The

ACTINOMYCOSIS IN THE ROOF OF THE MOUTH OF A BULL 18 MONTHS OLD

(Photo from Mr J D Allan Chief Food Inspector Liverpool)

Face p. 140

mucous membrane of the respiratory passages is generally inflamed and reddened, while a diphtheritic membrane may form upon its surface. Inflammation and discolouration of the mucous membrane of the mouth, pharynx, stomach, and intestine is also nearly always present, while a croupous-like membrane may be found on their surfaces, giving rise to the characteristic " croupous tubes ".

DIFFERENTIAL DIAGNOSIS FROM RINDERPEST

Malignant Catarrh	*Rinderpest*
Eyes frequently affected.	Seldom or never.
Involvement of respiratory apparatus.	Confined to lips and fauces.
The parenchyma of internal organs and the flesh show no variation from the normal.	Cloudy swelling and fatty changes generally present in the internal organs; flesh may be very dark coloured.

Judgment.—The entire carcass and all the organs should be condemned. (Memo. 62, Foods, Sec. V *A* 18.)

ACTINOMYCOSIS

Actinomycosis, known as " wooden tongue ", " lumpy jaw ", " big head ", &c., is caused by a parasitic fungus, the *Actinomyces bovis*, or " ray fungus ". Outside the animal body this parasite grows on grass and grain, especially barley, thus suggesting a mode in which infection may occur. The disease is frequently met with in this country. Cattle are principally affected, but it occurs in the pig, sheep, horse, and in man.

SYMPTOMS.—In the live animal the symptoms depend upon the site of the lesions. The head, particularly the lips, tongue, hard palate, and jaw are most often affected. There may be lesions of the skin and occasionally of the stomach, intestines, and mammary glands. Thickening and ulceration of the diseased part is found, and salivation and emaciation follow disease of the tongue. On palpation, nodules and enlargement of lips, tongue, jaw, or muscles of the cheek will be felt according to the tissue involved.

HEAD.—The tongue is more frequently attacked by the ray-fungus than any other part of the body. In this organ the disease may assume three forms: (1) Superficial ulcers on the mucous membrane; (2) Nodules on the exterior (see Plate XV); (3) Nodules and thickenings in the substance of the tongue, producing the condition known as "wooden tongue". Tongues are often only slightly affected.

A small ulcer at the boundary of the fixed and movable parts of the organ, probably produced by the retention of fragments of food, may be the only indication of the disease. All tongues should be carefully inspected for the presence of such small lesions, and if found, the lesion along with a free margin of healthy tissue should be cut out by the inspector, the remainder of the tongue being quite fit for human consumption.

The larger nodules, which form on the sides and dorsum, usually about the upper third of the tongue, tend to suppurate, giving rise to superficial ulcers, the floors of which are leathery to the touch, and are studded over with small yellow spots denoting the presence of colonies of the ray-fungus. Nodules and ulceration may also occur on the roof of the mouth. (See Plate XV.)

Wooden Tongue.—Where this condition is present the organ becomes enlarged, very firm and unyielding in consistence, due to the proliferation of fibrous tissue, which on cross-section is found to replace the muscular substance. Multiple tumours may be found scattered throughout the lingual tissue. Such tongues should be destroyed.

Bone.—Actinomycosis affecting the bony structures of the upper and lower jaw is also met with, and is popularly known as "lumpy jaw". In this condition large swellings are often found in the neighbourhood of the jaw. The bone becomes swollen, rarefied and carious, due to the growth of new-formed granulation tissue in its interior, which tends to open up and expand it. The process generally goes on to suppuration, when the resulting pus is discharged through cloacæ or openings which perforate the bone. The surrounding tissues are frequently implicated.

The Lungs may become infected directly by inhalation of dust containing the organism. Small nodules may be found scattered through the pulmonary tissue. Several of these situated near one another may soften, giving rise to an appearance somewhat resembling tuberculosis.

Lymphatic Glands.—The lymphatic glands in the neighbourhood of lesions may be affected, when they are swollen and œdematous, but do not show nodules visible to the naked eye. It is quite common, however, to find the lymphatic glands unaffected even when actinomycosis of the tongue and jaw is advanced.

It is stated that a form of the disease occurs, in which the glands of the neck become greatly enlarged, giving rise to tumour-like swellings at the angles of the jaw, interfering with swallowing and

ACTINOMYCOSIS IN THE TONGUE OF A BULL
AGED 18 MONTHS

1, Retro-pharyngeal gland incised, showing marked enlargement. 2, Epiglottis
Note also the nodules on the surface of the tongue
(Photo from Mr. J. D. Allan, Chief Food Inspector, Liverpool)

breathing. These swellings may burst and discharge yellow granular pus.

Generalized Actinomycosis.—It is rare for generalization to occur, the disease as a rule remaining local.

Differential Diagnosis.—All actinomycotic lesions are accompanied by a fibrous proliferation, which helps to distinguish them from tuberculosis. Although the corresponding lymphatic glands may be swollen they do not undergo calcification or caseous degeneration. As has been stated (p. 115) it is not possible to distinguish clinically between actinomycosis and actino-bacillosis, the only way to differentiate the one from the other is by means of the microscope. In true actinomycosis the granules are seen under the microscope to consist of clubs and gram-staining organisms which include branching filaments, whereas in actino-bacillosis the granules consist of masses of clubs without gram-staining filaments or organisms. In sections stained by carbol fuchsin or methyl-violet occasionally small patches of a minute bacillus can be demonstrated, in the case of actino-bacillosis between the clubs or in the central portion of the granule.

Judgment.—If there is evidence of generalized actinomycosis the entire carcass and all the organs shall be condemned. (Memo. 62, Foods, Sec. V *A* 1.)

ASPERGILLUS PNEUMONIA

The Aspergillus fungus may cause local patches of pneumonia in the lungs of cattle, although it is most frequently met with in birds. The lungs have a mottled appearance, due to patches of hepatization, the remainder of the animal being unaffected.

The condition can be diagnosed by microscopic examination which will reveal the fungus.

Judgment.—The lungs should be condemned. (Memo. 62, Foods, Sec. V *B*.)

CHAPTER VI

Pyogenic Diseases or those Characterized by Suppuration

Pyæmia, Septicæmia, Sapræmia

PYÆMIA

In pyæmia septic material is disseminated by the circulation throughout the system, giving rise to secondary foci, which develop into metastatic abscesses.

The pathological characteristics of pyæmia are, according to Ostertag, of two kinds:

(1) Local suppuration and the presence of osteomyelitis (generally brought about by staphylococci).

(2) Local suppuration and the presence of multiple inflammatory or purulent foci in other organs (due, as a rule, to streptococci).

The pyogenic organisms may gain access to the circulation in one of two ways: (1) By infecting the lymphatic system, which in turn empties them into the blood circulation. (2) When the blood-vessels are involved in the suppurative process of the primary focus, small fragments of tissue or blood clot containing bacteria may become detached and be carried by the blood stream to other parts of the body, there to set up a secondary purulent focus.

As might be expected, secondary foci or metastases appear first in the lungs, unless in those cases where the umbilical vein is affected, when the liver is the organ chiefly involved.

Three forms of pyæmia may be described: that occurring in connexion with bacterial endocarditis; osteomyelitis; and the so-called " navel ill " or joint ill of young animals.

Bacterial Endocarditis.—When ulcers form on the heart valves, fragments of tissue containing bacteria may become detached and be carried by the blood stream, generally to the lungs or spleen,

where secondary abscesses are produced. Such fragments of tissue are called emboli.

Osteomyelitis is a suppurative condition of the bone marrow, and is generally associated with abscesses of the hoofs, claw, or joints. It may be recognized in the early stages by the red or chocolate colour of the marrow, which later becomes purulent and more fluid than normal in consistence, so that it flows from the marrow cavity when the bones are cut in two.

Navel Ill and Joint Ill.—Navel ill is a term applied when the umbilical wound of newly born animals becomes septic, and discharges pus, instead of healing in the normal manner. This condition generally leads to " joint ill ", or umbilical pyæmia. The pyogenic organisms reach the liver by way of the umbilical vessels, giving rise to multiple abscesses in that organ. The blood stream frequently becomes involved, with the result that the abscesses are distributed throughout the other organs of the body. The joints, especially the hocks and knees, become swollen, the swelling being due to inflammation. When the diseased joints are incised they are found to contain a yellowish fluid, and the synovial membranes are congested and opaque. This disease may attack all young animals. A calf should never be allowed to pass through the inspector's hands until the hocks and knees have been inspected for the presence of " yellow water ".

Judgment.—The meat inspector must exercise great care in dealing with the flesh of pyæmic animals. The flesh of animals suffering from navel ill and joint ill have given rise to severe outbreaks of food poisoning. Whenever osteomyelitis is discovered, the whole carcass should be condemned without reserve. In cases of acute metastatic pyæmia, in which the secondary infections are fresh, the internal organs show cloudy swelling, the spleen is enlarged, and the animal in consequence is in poor condition, the whole carcass should be condemned. A carcass and all the organs should be condemned if there is evidence of pyæmia (including joint ill or umbilical pyæmia). (Memo. 62, Foods, Sec. V *A* 26.)

SEPTICÆMIA

Two forms of this disease probably occur in animals:

(1) Where the bacteria remain and multiply at the point of inoculation, giving rise to toxins which produce characteristic symptoms.

(2) Where organisms having the power of living and multiplying in the blood are introduced into the circulation, in which they may be found in enormous numbers, producing toxins as a result of their growth.

Appearances in Cases of Septicæmia.—No large suppurating focus is to be found in the internal organs. Small patches of hæmorrhage are of frequent occurrence in the mucous and serous membranes, and also in the lymphatic glands, which are swollen. Cloudy swelling of the liver, kidneys, and heart is typical of the disease. These organs are enlarged, sometimes to a high degree, and have a bulky appearance on section, while the tissue has an opaque, grey, dull colour. If the animal be seen in the live condition, it exhibits high fever, accompanied by weakness and depression, and looks very ill. The comparatively trifling appearances found on post-mortem examination, compared with the severe disturbances during life, should always make one suspicious of septicæmia.

Septicæmia is frequently associated with septic metritis, septic diseases of the udder in cows, certain indefinite intestinal diseases of a septic nature in calves and adult cattle, and also with a form of calf lameness which resembles very closely navel or joint ill, already described.

Septic Metritis is an inflammation of the womb, brought about by organisms which gain entrance through the genital tract. It may be associated with retention of the placenta (after-birth), in which case a thick brownish red fluid, with an offensive smell, will generally be found in the cavity of the uterus.

In cases of difficult parturition, injuries to the genital tract may be received and septic metritis set up. Under such circumstances the uterine walls become thickened and œdematous, the mucous membrane congested, while a considerable quantity of pus, with a very offensive odour, collects in the cavity of the womb. In consequence of the uterine disturbances, the iliac glands become much swollen. The peritoneum may become infected from the uterus, and show signs of an inflammatory condition, accompanied by the formation of a fibrous membrane on its surfaces.

During life the animal's health is severely disturbed, due to the absorption of bacterial products. After slaughter the flesh may be fevered, and cloudy swelling of the tissues of the internal organs is generally found.

Septic Mastitis differs from the ordinary inflammations of the udder, which produce but little disturbance of the animal's

health, and do not impair the wholesomeness of the meat. In septic mastitis the general health rapidly becomes so bad that the animals are often slaughtered to prevent their dying in their owner's hands. In a case seen by Ostertag, which had been subjected to emergency slaughter, there was excessive cloudiness of the liver, which was yellow and soft, and of the heart and kidneys. Petechiæ were found under the serous coat of the intestine, the visceral layer of the pleura, and the epicardium. All four quarters of the udder were greatly swollen. During life the animal had not eaten for three days, but had a great thirst.

Septic Intestinal Diseases.—Ostertag states that there are certain intestinal diseases of cattle of an undoubted septic nature the symptomatology of which is obscure.

Judgment.—Septicæmia is the most dangerous of all diseases from the meat inspector's point of view. In Germany outbreaks of food poisoning have been ascribed to the consumption of the meat of cows which have died of, or have been slaughtered while suffering from, septic metritis or mastitis. The entire carcass and all the organs should be condemned when there is evidence of septicæmia or septic intoxication or acute septic metritis. (Memo. 62, Foods, Sec. V *A* 22 and 29.)

SAPRÆMIA

When the blood supply to the part is cut off, the tissues in consequence die. One or two examples of such an occurrence may be considered.

After the birth of an animal, the placenta or after-birth should be expelled from the womb of the mother. It may happen, however, that it is not expelled, but remains instead a mass of dead tissue in the womb.

Necrosis of the lung, where part of the pulmonary tissues dies, owing to its blood supply being cut off, is a further example.

If blood escapes into some region of the body, due to rupture of a vessel or some other cause, and becomes clotted, a mass of dead tissue may be formed.

When such dead tissue is situated in parts connected with the outside world, as in the uterus, lung, &c., saprophytic organisms may gain entrance, and finding a suitable nidus on which to multiply give rise to putrefaction, with the formation of poisonous toxins.

These poisonous products are absorbed by the surrounding living tissues, and entering the blood stream produce a condition of sapræmia which is characterized in the live animal by acute fever and diarrhœa, &c.

It is seldom that sapræmia is found without some pathogenic process being present also, which not infrequently has caused the sapræmia by interfering with the blood supply of the part. Or again, the pathogenic process may be secondary to the saprophytic, because the poisons produced by the latter condition may so weaken the vitality of the surrounding living tissues as to render them an easy prey to the pathogenic organisms.

Judgment.—Whenever a putrefactive process (which may be recognized by its offensive odour) is discovered, or signs of peritonitis resulting from a perforation of the intestine, or any other condition where a dead putrefactive mass is found, the whole carcass and organs should be condemned, as, even when cooked, they are apt to possess a decomposed odour, and may contain products highly injurious to the health of the consumer.

The entire carcass and all the organs should be condemned if there is evidence of septic intoxication. (Memo. 62, Foods, Sec. V *A* 29.)

CHAPTER VII

Diseases caused by Parasites

Tapeworms or Cestodes: *Cysticercus bovis—Cysticercus cellulosæ—Cysticercus tenuicollis—Cœnurus cerebralis—Echinococcus veterinorum—Cysticercus pisiformis—Cysticercus serialis.*
Flukes or Trematodes: Liver Fluke.
Round Worms or Nematodes: *Trichina spiralis—Ascaridæ*—Strongyli—*Echinorrynchus gigas—Œsophagustoma columbianum—Onchocerchiasis.*
Miscellaneous Parasites: Coccidia—Sarcosporidia—Pentastomum.
External Parasites: Fleas—Lice—Mites—Bots and Warbles—Maggots—Ticks.
Piroplasmosis: Texas Fever—Red Water Fever.

ANIMAL PARASITES

Parasites are incapable of leading an independent existence; they live in, or upon, other animals, either temporarily or permanently, and derive nutriment from them. The animal upon or in which the parasite lives is termed its " host ", and the part in which the parasite lodges is called its " habitat ". The development of parasites may be direct (from ova or eggs) or indirect, where an intermediary, or temporary, host is required for the development of one or more stages of the parasite. The ova, embryos, or parasites may be conveyed from place to place on skin, hides, wool, feet of animals, or birds, and may be passed from the animal body in the excretions, and distributed in dung or offal. When they gain access to animals suitable for their development, they may become mature parasites in the host, or may develop into immature forms in the intermediary host, and await a suitable host for maturation.

Parasites may cause little more than irritation, they may destroy organs and render carcasses unfit for food, or they may carry disease from one host to another. Only a few animal parasites are transmissible to man.

Classification of parasites is extremely complicated, but for the present purpose they may be divided according to their habitat into:

A. Entozoa: those in which transformation occurs within the body of the host.

B. Ectozoa: those in which transformation occurs outside the body of the host.

Entozoa are divided into three main groups:

(*a*) Cestodes: tapeworms and their cysts or " hydatids ".

(*b*) Trematodes or flukes.

(*c*) Nematodes or round worms.

CESTODES

Tapeworms have heads provided either with suckers or hooks, or both, by which they become firmly fixed to the digestive tract of their host. The tapeworm body is long and segmented, and, when ripe, the segments full of eggs are either passed in the excreta or they may burst and discharge their eggs into the intestine, to be evacuated with the fæces. Meantime, the head of the worm remains in situ, new segments are formed and the process is continued.

When the eggs reach the outside world, they are consumed by a suitable host along with food or drink; the outer coverings of the eggs are digested, setting free the embryos contained. These penetrate the tissues and are taken up and carried by the blood stream to suitable organs and tissues, where they develop into cysts containing the heads of the future worms. If tissues containing the cysts are in turn eaten by a new host, the cyst wall is digested, thus liberating the head of the worm, which becomes fixed on the intestinal walls where a mature tapeworm develops.

Certain tapeworms are communicable to man through eating infected meat, others are not.

CESTODES COMMUNICABLE TO MAN—1. *Tænia saginata* or *Mediocanellata*, the bladder-worm, or Cysticercus form, of which occurs in cattle and is known as *Cysticercus bovis*.

2. *Tænia solium*, the tapeworm, of which the bladder-worm form occurs in the pig as *Cysticercus cellulosæ*.

Cysticercus bovis, or the beef bladder-worm, occurs as a small roundish grey semi-transparent object in the connective tissue between the muscle fibres. It varies in size from a pinhead to that of a pea, according to its stage of development. If muscles containing this parasite are sectioned, a number of small whitish spots are seen scattered through their substance. When these are examined more closely they are found to consist of a sac filled

with fluid and a scolex (head and neck) which is invaginated into the sac. Examined under the microscope the head is found to possess four sucking-discs but no hooks. There may be numerous lime corpuscles on the neck.

Cysticercus bovis is most frequently found in the masticatory muscles and heart. In exceptional cases it has been found in the lungs, liver, brain, &c.

LIFE HISTORY.—Should raw or imperfectly cooked flesh containing cysticerci be eaten by man, the head of the cysticercus, on reaching the intestine of the consumer, attaches itself to the intestinal mucous membrane. The sac disappears, and from the head a series of oblong segments called proglottides grow. Thus a chain of proglottides, or segments, reaching perhaps the length of several feet, is developed, which along with the head constitutes the adult tapeworm. The head of *Tænia medio-canellata*, as the adult tapeworm is called, is similar to the scolex from which it was produced; it possesses four suckers but is devoid of hooklets. Each segment is provided with both male and female generative organs. When the proglottides become mature they sever their connexion with the worm and become separated from its lower extremity one by one. They pass down the alimentary canal and are discharged with the fæces. By the decomposition of the proglottis the ova are set free, and may be devoured by cattle along with grass or other vegetable matter. In the intestine they develop into embryos which burrow into the solid tissue of their host where they form cysticerci.

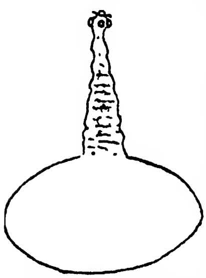


Fig. 1.—Pig Bladder Worm or *Cysticercus cellulosæ* (magnified).

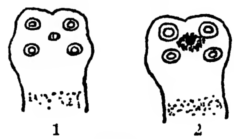


Fig. 2

1, Head of *Cysticercus bovis* (magnified). It possesses four suckers but no hooklets. 2, Head of *Cysticercus cellulosæ* (magnified). It possesses, besides four suckers, a double circle of hooklets.

Judgment.—The carcass and all the organs should be condemned if *Cysticercus bovis* is found generalized in the meat substance. (Memo. 62, Foods, Sec. V *A* 6.)

Cysticercus cellulosæ, found in the intermuscular connective tissue of the pig, bears a very strong resemblance to *Cysticercus bovis*. The bladder, or cyst, is, however, more transparent, so that the invaginated head can more easily be seen through it. On microscopic examination of the head it is found to possess, besides four suckers, a double circle of hooklets, and may be readily distinguished from *Cysticercus bovis*, which has four suckers but no hooklets.

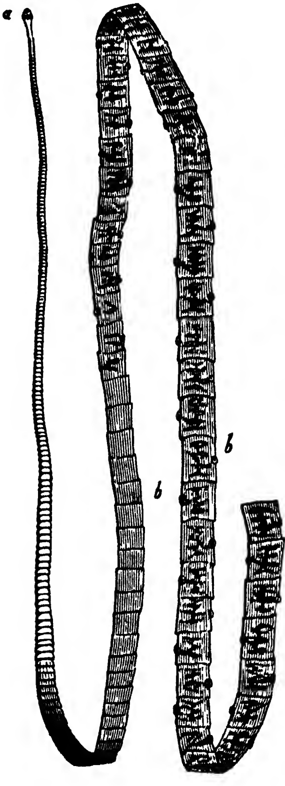
The tapeworm *T. solium* develops from *Cysticercus cellulosæ* in

a manner similar to that in which *T. mediocanellata* develops from *Cysticercus bovis*. The head of *T. solium* has the same characteristics as the head of *Cysticercus cellulosæ*, and may thus be identified.

DEGENERATION.—Cysticerci found in the ox and pig, but especially in the latter animal, frequently show degenerative changes. They either become caseous, when they have a grey colour, or else calcareous, when they assume a pure white. Such dead cysticerci are just visible to the naked eye, and present the appearance of white granules in the musculature. Under the microscope a calcified centre surrounded by a fibrinous membrane, and occasionally hooks and calcareous corpuscles, may be seen.

Thorough cooking, pickling, or freezing of the meat at low temperatures is said to destroy cysticerci.

Judgment.—The entire carcass and all the organs shall be condemned if evidence of *Cysticercus cellulosæ* (measly pork) generalized in the meat substance is found. (Memo. 62, Foods, Sec. V *A* 7.)



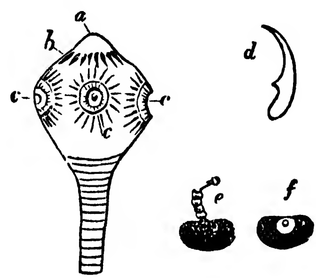


Fig. 3

Tænia solium showing (*a*) Head and the long flattened tapelike body, which may be from 4 to 10 ft. in length, and which is made up of a large number of segments or joints called proglottides (*b*). Note that the more mature proglottides present a genital apparatus and genital aperture.

Head of *Tænia solium* (magnified). *a*, Rostellum; *b*, circle of hooklets; *c*, suckers; *d*, one of the hooklets greatly magnified; *e*, *Cysticercus cellulosæ* with head protruded; *f*, *Cysticercus cellulosæ* with invaginated head.

(The bladder-worm stage of the tapeworm *Bothriocephalus latus* is found in certain fish, and may be transmitted to man by eating the latter—see p. 248.)

PLATE XVII

LIVER OF PIG ENLARGED FROM THE PRESENCE OF ECHINOCOCCUS CYSTS

(Photo from Mr J D Allan Chief Food Inspector Public Health Department Liverpool)

Face p 13[illegible]

CESTODES WHICH ARE NOT TRANSMITTED TO MAN THROUGH EATING MEAT

Cysticercus tenuicollis is the bladder-worm form of *Tænia marginata*, which inhabits the dog's large intestine. It is most commonly met with in sheep, much less frequently in pigs or cattle. The bladder of this parasite varies in size from a pea to that of a goose egg, according to its state of development. It has a long corrugated neck, at the end of which the head is situated; the latter has a double row of hooklets, not unlike those of *Cysticercus cellulosæ*. It is found chiefly in the peritoneum and pleura, and under the serous covering of the internal organs. The liver is sometimes invaded, when the parasite may be found in the interior of the organ. In serous cavities the cysticerci are found situated in adventitious sacs formed of the peritoneal or pleural tissue.

Cysticercus tenuicollis may be distinguished from *Cysticercus cellulosæ* by the fact that it is usually much larger, possesses a longer neck, and is found as a rule in the abdominal cavity.

When in a caseous or calcified condition this parasite might be mistaken for tubercle; an inspection of the glands in the neighbourhood, however, will show the absence of tuberculous alteration.

Judgment.—If the carcass be in good condition, it may be passed, after the affected organs or parts have been removed. If emaciated, it should be judged according to the degree of emaciation.

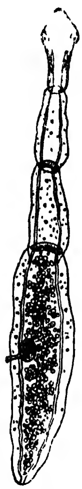
Cœnurus cerebralis is the cystic or bladder-worm stage of *Tænia cœnurus*, which inhabits the dog. It may be found located in the brain or spinal cord especially of sheep, but occasionally of cattle, and gives rise to the disease called Sturdy or Gid. The cyst, which is of a rounded or elliptical form, varies in size from that of a canary seed to that of a hen's egg. The scolices, or heads, develop from the inner wall of the cyst, and may be very numerous. The presence of this parasite sometimes gives rise to marked emaciation.

Several tapeworms may be found in the intestinal canal of sheep and cattle, their only significance being that they occasionally give rise to cachexia and emaciation, which renders the carcass of the affected animal unfit for the market.

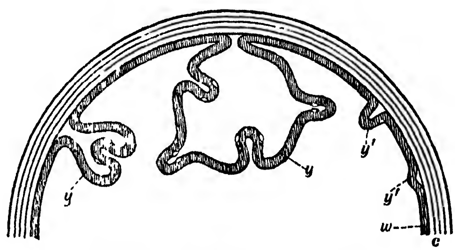
Hydatid Cyst or Echinococcus veterinorum is the bladder-worm stage of *T. echinococcus*, a small tapeworm consisting of three or four segments, the terminal one containing the ova, which finds a habitat in the intestine of the dog. The ox, sheep, and occasionally the pig, may all be infected with the bladder-worm stage of this parasite, while cases of its occurrence in the human subject are by no means rare. The bladders or cysts of the echinococci

vary in size, depending upon their state of development. When fully formed, they vary in size from that of a marble to a hen's egg. The cyst contains a non-albuminous fluid, and is lined inside by a germinal layer. Outside this there is a laminated structure, while externally the parasite is surrounded by an adventitious cyst-wall of fibrous tissue. Elevations appear on the inner germinal layer, which later become hollow, forming brood capsules. From the wall of the brood capsule the head, or scolex, develops, and many heads may be found in one brood capsule. The head possesses a rostellum surrounded by a double row of hooklets. From the outer or inner layers of the parasite, daughter cysts may form, giving rise to multilocular and racimose cysts which are frequently found in the livers of cattle.

Hydatid cysts occur most frequently in the liver and lungs; they may also be met with in



Tænia echinococcus (magnified)



Diagrammatic Section through a Cyst
w, wall; *c*, cuticle; *y*, brood-capsule; *y'*, the same in an incipient state (after Boas).

Fig. 4

the spleen, heart, kidneys, peritoneum, bone marrow, and occasionally the muscles and lymphatic glands.

Liver.—In this organ only a few or several hundreds may be found; in the latter case the liver is very greatly enlarged and increased in weight. When the hydatids are normal, little trouble will be experienced in recognizing them. When, however, they undergo caseous degeneration they may be mistaken for caseous encapsuled tuberculosis. The freedom from tuberculosis of the corresponding lymphatic glands and the fact that, in the absence of the disease in other organs and parts, the liver is seldom the seat of primary tuberculosis, should, however, serve to distinguish the one condition from the other. (See Plates XVII, XX, pp. 132, 142.)

HEART, SPLEEN AND KIDNEYS (PIG), SHOWING ECHINOCOCCUS CYSTS

(Photo from Mr. J D. Allan, Chief Food Inspector, Public Health Department, Liverpool)

LUNGS.—The lungs are seldom so extensively invaded as the liver, only a few hydatids generally being present. They may be situated near the surface of the organ, when they appear as swellings under the pleura.

Judgment.—As stated, man may be infected with hydatids; he becomes infected, however, by water, vegetables, &c., contaminated by the fæces of dogs which contain the ova of the parasite, and not by eating flesh containing hydatids. The *T. echinococcus* does not develop in the intestine of man. The general condition of the animal's nutrition is frequently but little disturbed by the presence of hydatids in its organs. The organ or portion of the carcass affected only should be condemned, unless general dropsy or general pathological emaciation is present, when the entire carcass and all the organs should be condemned. (Memo. 62, Foods, Sec. V *A* 9 and 10 and *B*.)

Cysticercus pisiformis.—This hydatid is the immature form of the *Tænia serrata*, a tapeworm found chiefly in sporting dogs. The cysts are found on the omentum of the hare and rabbit, and look like clusters of grapes. They appear to do little harm as a general rule, but in some cases emaciation results.

Cysticercus serialis.—The cysts, which are immature forms of a tapeworm of the dog, may be found under the skin of the neck, back, and loin of the rabbit, and vary in size from that of a hazel-nut to that of a hen's egg. They may be distinguished in life by running the hand along the back and the inside of the thighs, when the cysts will be felt as elastic swellings. In the carcass they are easily seen. The flesh in affected animals is pale and flabby and not suited for human food.

TREMATODES OR FLUKES

Flukes are not transmissible to man through eating meat, and are important only because of the deterioration which they may cause in the carcass of their host.

Liver Fluke.—A small snail acts as the intermediary host for the liver fluke. They occur in wet seasons in great numbers on the pasture land of infected areas, and are eaten by the beasts. Sheep are specially liable to fluke disease as they eat close to the ground and pick up the snails on the grass.

DISTOMATOSIS or ROT is the condition brought about when liver flukes are found in the liver of any animal. Sheep and cattle are chiefly affected. There are two flukes commonly met with by

meat inspectors: *Distoma hepaticum* and *Distoma lanceolatum*, the former more frequent than the latter.

Distoma hepaticum resembles somewhat a miniature sole fish; it measures about a half to one inch in length, and about half an inch in breadth. The integument of this fluke, which is of a brownish colour round the edge, and of a brighter tint in the centre, is covered with spines. An oral sucker is situated on the oval surface of its head. (See Plate XIX.)

Distoma lanceolatum is lance-shaped, being shorter and narrower than *D. hepaticum*, and its cuticle bears no spines. Its length does not exceed half an inch.

The liver is the part most commonly affected by fluke, and when extensively invaded it becomes somewhat enlarged, whilst a catarrhal-like inflammation is set up in the bile ducts, as a result of which they become greatly thickened and very white in colour. This process may go on to calcification. When the large bile ducts become inflamed, they stand out upon the gastric surface of the organ and are very noticeable. The liver tissue may not be much changed, but as a rule it presents a greyish appearance and becomes firm to the touch. A well-marked cirrhosis of the hepatic tissue is sometimes found along with proliferation of the fibrous tissue.

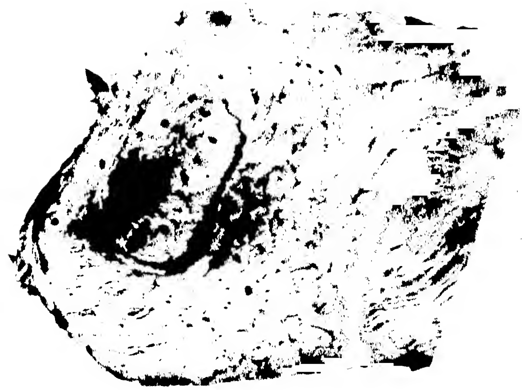
Even though present in the liver, flukes are sometimes difficult to find. When the liver is sectioned, the flukes may be seen coming from the ducts and falling out of their cut ends, occasionally in great numbers.

The presence of these parasites in the liver, at least in the early stages, does not seem to interfere much with the nutrition of the animal. Indeed, it is the practice of farmers in certain parts of the country to put their cattle on pastures known to be infected with fluke, because it is their belief that animals which harbour this parasite fatten quicker, and there appears to be little doubt that a slight infection of the liver may give rise to such a result.

When an extensive invasion of the liver has taken place, however, the carcass, especially of sheep, becomes much emaciated and unfit for food. That of the ox does not, as a rule, show so great emaciation.

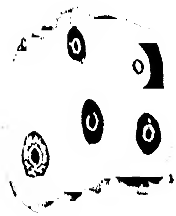
Flukes may occasionally be met with in the lungs, when they give rise to a tumour with fibrous walls.

Judgment.—The organ or portion of the carcass affected should be condemned, but if there is general dropsy or emaciation, the entire carcass and all the organs should be condemned. (Memo. 62, Foods, Sec. V *A* 9 and 10 and *B*.)



MIESCHER'S SACS OR RAINEY'S CORPUSCLES IN MUSCULATURE OF PIG (natural size)

Trichinous musculature of pig with well developed polar fatty tissue (nat. size)



Cysticercus Bovis or the Beef Bladder worm in muscle (nat. size)

SMALL INTESTINE OF AMERICAN OX

With small rounded tubercles caused by the parasite *Oesophagostomum Columbianum*. This parasite may also be found in the intestine of the sheep. When present the intestine should be condemned for sausage skins, but the rest of the animal may be admitted to the market.

The Liver Fluke—*Distomum Hepaticum* (nat. size)

NEMATODES OR ROUND WORMS

This class of worms comprises many varieties, but only one is transmissible to man through eating meat, and it is important because it is capable of giving rise to serious disease.

Trichinella or Trichina spiralis.—The encysted larval form of this parasite is met with in the muscles of the pig where it may occur in immense numbers. As seen with the naked eye the affected muscles seem to be dusted throughout with fine white particles resembling sawdust (see Plate XIX). On microscopic examination of the fine particles, each is found to consist of an oval cyst, within which a small worm is coiled up in a spiral manner. Abundant calcareous particles are often present in the wall of the cyst, especially at the poles; and when old, the impregnation with lime may be so great as to obscure the parasite unless the lime be first dissolved with acid.

Life History.—The life cycle in man and animals is the same. The disease produced in man by the ingestion of this parasite is known as trichinosis. If raw or imperfectly cooked pork containing trichinæ be eaten, the capsules are dissolved by the gastric juice and the embryos are set free. These embryos grow rapidly in the small intestine and reach the adult form in the course of two and a half days. The females are then impregnated by the males and give birth to large numbers of embryos, which penetrate the intestinal wall and are conveyed (probably by the lymph and blood streams) into the muscles, where they become encysted. This transition stage of trichinosis, when the embryos are making their way from the intestines to the muscles, is accompanied by acute muscle pains and fever.

In the pig the encysted parasite is found most abundantly in the muscular portion of the diaphragm, the muscles of the larynx and tongue, and less frequently in the abdominal and intercostal muscles. In well-fed animals a development of fat may take place around the poles of the capsule, rendering the trichinæ clearly visible to the naked eye. When completely calcified, also, they are more noticeable than otherwise. The only satisfactory method of carrying out an inspection for trichinæ is by means of the microscope. In Germany, where the flesh of pigs, in the form of ham which is merely smoked and has received no cooking, is consumed in large quantities, a special " Trichina Inspection " is made. To discover the presence of trichinæ, four samples are taken from each pig by a man who does nothing else, as follows: (1) from the midriff of the diaphragm; (2) from the diaphragm in the neighbourhood of the ribs; (3) from the laryngeal muscles; and (4) from the muscles on the under side of the

tongue. These samples are put into a small metal box, bearing a number corresponding to that stamped on the carcass of the animal from which they were removed. The boxes are conveyed to special rooms, where the samples are microscopically examined. The examiner cuts six small pieces of about the size of a grain of wheat from each of the four samples presented to him. These he places on a specially prepared piece of glass divided into twenty-four divisions, and then lays a corresponding piece of glass on the top and exercises gentle pressure. He next clamps the two glass plates together by means of screws when twenty-four microscopic specimens are ready for examination. The rule generally followed is that, if he has carried out the preparation properly, each specimen is so thin as to enable him to read print of an ordinary size through it. The specimens are examined under a magnification of forty or fifty diameters; greater magnification is unnecessary and unsatisfactory, as more time would be required for examining the specimens were it employed.

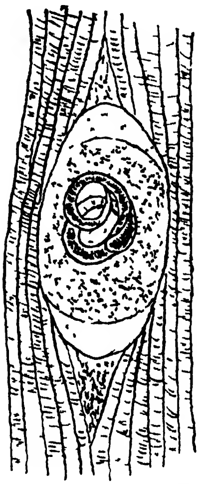


Fig 5 —Microscopical Appearance of Encapsuled Trichina in Muscle of Pig

Miescher's sacs or Rainey's corpuscles are the only parasites likely to be mistaken for trichinæ. These are described under Sarcocysts on p. 143.

The pig becomes affected with trichinæ by eating trichinous rats, or infected offal from slaughter-houses, &c. The disease is not common in this country, but is stated to occur frequently in India, China, Algeria, East Africa, and Australia. In America from 1–2 per cent of pigs are said to be infected. The best preventive measure is that of thorough cooking of all pork. Unless very thoroughly carried out, salting, pickling, and smoking are not adequate safeguards. Refrigeration of pork at 50° F. for not less than twenty days is stated to kill the larvæ, hence very cold storage is effective. Rats should be excluded from all slaughter-houses, piggeries, &c.

Judgment.—The entire carcass and all the organs should be condemned in trichinosis. (Memo. 62, Foods, Sec. V *A* 32.)

NEMATODES NOT TRANSMISSIBLE TO MAN BY EATING MEAT

Ascaridæ or Common Round Worms.—All domestic animals are hosts for ascaridæ, each being specially named according to its host. The ascaridæ are rarely found in cattle or sheep, but are frequently seen

in pigs, the *Ascaris lumbricoides* being the most common. It is from 3 to 6 inches long and may be found in large numbers, causing, in rare cases, jaundice from its presence in the bile ducts, or obstruction if in the small intestine. Flesh of animals heavily infected with ascaridæ is said to have an unpleasant odour and taste, but no ill effect follows eating such meat.

Strongyli are small round worms whose habitat is the lungs and stomach of various animals. In the lungs they cause catarrhal bronchitis and broncho-pneumonia, and when in large numbers are responsible for emaciation and dropsy. They are found most commonly in young animals and cause much irritation with frequent husky cough; the condition is often known as " husk " or " hoose ". Inflammation of the trachea or bronchi will be found with exudation of mucus, and where pneumonia is present patches of consolidation occur. Certain forms of strongyli inhabit the stomach where they form nodules.

The worms most commonly met with are as follows:

Strongylus equinus or *vulgaris* in the horse, *S. micruris* in the calf. *S. paradoxus* in the pig, *S. rufescens*, *S. filaria* in sheep and goats.

STRONGYLUS MICRURIS.—In the lungs of young cattle this worm appears as threads of milky-white colour and may form patches in the lungs resembling mother-of-pearl.

STRONGYLUS RUFESCENS is a smaller worm than the other varieties; it is brown in colour and is found in the substance of the lungs. The eggs, or embryos, are deposited immediately beneath the pleura, where they form firm nodules, often grey in colour though they may be brown or green on the surface. When incised, the nodules are found to contain embryos curled up in the centre of the lesions. The condition brought about by *Strongylus rufescens* is frequently known as " pseudo-tuberculosis " because of its resemblance to tuberculosis. The latter is, however, seldom or never found in sheep, whereas in cattle it is one of the commonest diseases.

" In the ox about 90 per cent of tuberculous-looking lesions in the internal organs are due to the tubercle bacillus. In the sheep and goat an even larger proportion of lung tubercles are caused by parasitic embryos " (Stockman).

Strongylus rufescens occurs in the lungs of adult sheep and goats, but also occasionally in cattle.

STRONGYLUS CAPILLARIS is most frequent in the lungs of sheep and goats, and causes bronchitis or patches of broncho-pneumonia.

STRONGYLUS FILARIA inhabits the lungs of sheep and goats, and may be in bundles the size of a walnut on the bronchi, or may give rise to pneumonia.

STRONGYLUS PARADOXUS occurs in the lungs of pigs, and may cause bronchitis and dilatation of the bronchi, but does not give rise to broncho-pneumonia. Mother-of-pearl-like patches may be seen at the bases of the lungs due to the parasite.

STRONGYLUS CONTORTUS is found in the abomasum of cattle, sheep, and goats. In small numbers little damage appears to result, but in the sheep, diarrhœa, anæmia, and wasting may occur if the parasite is present in large numbers.

STRONGYLUS CONVOLUTUS occurs in the abomasum of cattle. Most frequently, however, it is seen in young calves. In the latter animals it gives rise to diarrhœa and emaciation. The parasite forms nodules underneath the mucous membrane of the abomasum.

Judgment.—Where there is associated emaciation or dropsy the carcass and all the organs must be condemned, but where there is bronchitis or broncho-pneumonia only, the affected organs alone should be condemned. (Memo 62, Foods, Sec. V *A* 9, 10, and *B*.)

Echinorrynchus gigas is a round worm of considerable length found in the small intestine of pigs from abroad. The female is from 10 to 14 inches long, and has bristles on its proboscis, which help it to bore into the intestinal mucous membrane. Abscesses and ulcers result, and render the intestine unfit for sausage casings. Occasionally perforation takes place, resulting in peritonitis, which renders the whole carcass unfit for food.

Œsophagustoma Columbianum is a small round worm which in the mature state is about half an inch long. It has for its habitat the intestines of cattle and sheep. It is fairly common in this country, and, unless very numerous, does not appear to affect the health of the animal, but when present in large numbers, anæmia and marasmus may result. The encysted embryos may be found beneath the mucous membrane of the intestines anywhere between the duodenum and the anus, but are most common in the small intestine in the region of the cœcum. The nodules produced by the parasites are usually spherical, and vary in size from that of a pin-head to that of a hazel-nut, each nodule containing only one worm surrounded by a pinkish yellow cheesy material. The condition is known as "pimply gut" and infected intestines are unsuitable for sausage casings. (See Plate XIX.)

Judgment.—The affected organs should be condemned, but if anæmia or emaciation is pronounced the entire carcass and all the organs should be condemned. (Memo 62, Foods, Sec. V *B* and *A* 2 and 10.)

Onchocerciasis.—The parasitic condition known as Onchocerciasis is met with in Australian beef. A description of this condition formed the subject of a report by Dr. MacFadden and Dr. Leiper to the Local Government Board, and it is from that publication that the following information has, for the most part, been derived.

The condition termed Onchocerciasis is met with in frozen beef imported from Australia. It is recognized by the presence of nodules or tumours, which vary in size from that of a pea to that of a walnut and are almost always found in the connective tissues (see Plate XX). Such nodules, which are sometimes called by butchers " White Kernels ", " Parasitic Nodules ", " Worm Kernels ", " Worm Nodules ", " Worm Nests ", " Parasitic Tumours ", " Spiropteric Tumours ", or " Worm-nest Tumours ", are most often found in the forequarter, the affected area being generally limited to the flank and brisket. The hind-quarters are, however, also liable to be affected to a lesser extent, the parasite in this situation being as a rule confined to a small area over the stifle joint with a somewhat narrow extension downwards along the front of the leg.

Dr. Leiper says:

" Whatever the position of the nodule, its characters are essentially the same. In shape it is oval, to the touch firm and resilient; its surface is closely matted and smooth, and it lies in a stroma of connective tissue from which, in the thawed-out condition, it can easily be excised, without rupture, if its presence is previously determined by palpation. Within the fibrous capsule of the nodule are always found one or more long thread-like worms, not unlike cat-gut in appearance and inextricably coiled in a delicate meshwork of fibres.

" In all cases the exciting cause of the nodule formation is essentially the same, viz. a round worm of the family of Filaridæ and belonging to the genus *Onchocerca*.

" The Parasites.—When an unruptured nodule is carefully incised with a sharp knife to the depth of about a quarter of an inch and then prised open with the fingers, a number of small loops of what appear to be pieces of cat-gut spring up into the base of the incision. These are portions of the body of the female worm, and it is noticeable that to the naked eye they show a faint but regular transverse striation. Towards the centre of the nodule the male worm may be found by careful searching. This is recognized by its very slender form, its apparent lack of striation, and its loose attachment to the stroma of the nodule.

" The anatomical characters usually presented by the worms which I have examined may now be described:

"*Anatomy of the Male Worm.*—The male worm is hair-like, and measures 1½ to 1¾ inches in length. At no part of the body is the skin raised into thick transverse ridges so characteristically present in the female. The body tapers very gradually towards both extremities from the middle third of the worm, where the diameter is about 0·15 mm. The anterior portion is quite straight, but the posterior end is ventrally coiled. Except anteriorly, where the skin appears to be quite smooth, there are regular fine striæ crossing the cuticle at 0·045 mm. apart.

"*Anatomy of the Female Worm.*—The female worm could only be examined in short lengths owing to the extraordinary manner in which she threads her body through the connective tissue stroma in the centre of the nodule.

"No accurate estimate can be given of the entire length of the worm. In transverse measurement pieces apparently from about the middle of the body are 0·4 to 0·5 mm."

Dr. Leiper concludes his report with the following summary and conclusions:

"1. The parasitic nodules in Australian beef are, without exception, due to the presence of long thread-like worms of the genus *Onchocerca.*

"2. The diseased condition, Onchocerciasis, is not peculiar to Australian cattle, but occurs also in other animals and in various parts of the world, including the United States of America.

"3. The parasites belong to a group of worms that require to be taken up by a biting insect and to undergo a certain degree of development therein before they can be transmitted to another warm-blooded animal.

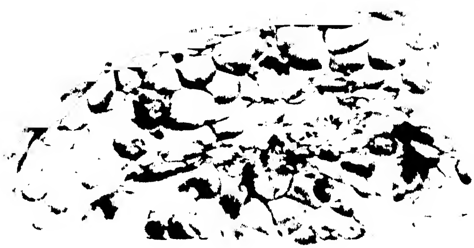
"4. The worms and their young do not appear to be capable of surviving for more than a few hours the death of the cattle. No evidence of vitality of the worm or its embryo has been met with in the case of Australian beef reaching this country.

"5. From (3) and (4) above, it follows that the direct development of the parasite in man as a result of eating the affected meat is impossible.

"6. The nodules are the product of changes taking place in the tissues as a result of some acrid toxin excreted by the worms. In my opinion their presence in meat intended for human consumption is undesirable for this reason."

Judgment.—The organ affected or portion of the carcass should be removed, the remainder of the carcass being fit for human consumption. (See Memo. 62, Foods, Sec. V *B.*)

ONCHOCERCIASIS IN BEEF



CUT SURFACE OF OX LIVER SHOWING HYDATID CYSTS

MISCELLANEOUS INTERNAL PARASITES

Coccidia.—The disease known as coccidiosis is caused by a one-celled parasite known as a coccidium, which is commonly found in the rabbit.

The *Coccidium oviforme* is the sporozoom which infects the rabbit. Egg cysts or eggs protected in firm envelopes are swallowed, the wall is digested and the coccidia enter the epithelial cells of the intestine, the intestinal glands, and the liver. In acute cases the animals become emaciated, suffer from diarrhœa and die, and there is little to be seen except intestinal inflammation. The presence of the parasites can be detected by the microscope.

In chronic cases the animals become listless and diarrhœa and emaciation follow. White patches, from a pinhead in size to that of a pea, containing cheesy matter, are seen in the liver and may also occur in the intestinal walls. The foci in the liver consist of greatly distended bile ducts surrounded by fibrous tissue and containing large numbers of coccidia. The disease has been given the name of " spotty liver ".

The *Coccidium zurini* of cattle causes acute enteritis or dysentery with diarrhœa containing blood.

Coccidium perforans inhabits the intestinal wall of rabbits, sheep, and calves, and gives rise to diarrhœa.

Coccidium fuscum occurs in the pig and gives rise to shot-like nodules in the skin.

Judgment.—The organ or portion of the carcass affected should be condemned. (Memo. 62, Foods, Sec. V *B*.)

Sarcosporidia.—There are two types of sarcosporidia giving rise to sarcosporidiosis: (1) *Sarcosporidia Miescharia*, which inhabit muscle fibres, and (2) *Sarcosporidia Balbianiæ*, inhabiting connective tissue.

Sarcocysts or Miescher's Bodies may be found in the muscles of horses, cattle, sheep, rabbits, dogs, chickens, &c., and are caused by the *Sarcosporidium Mieschariaum*. They are cigar-shaped bodies which vary much in size, sometimes being visible to the naked eye, and sometimes requiring the microscope for detection. They lie in the long axis of the muscle. Examined under the microscope, they are found to be cysts surrounded by a striated membrane and containing a number of kidney-shaped bodies. These parasites may undergo calcification and are then difficult to distinguish from trichinæ.

They do not seem to be transmitted to man by eating flesh, and are indeed seldom met with in the human subject.

Sarcosporidium balbianum causes large nodules in the connective tissue and may attain the size of a hazel-nut. They are surrounded by a capsule and contain crescent-shaped bodies and pus. They are common in the muscles of the neck, thighs, and trunk, and, when numerous, cause inflammatory changes.

The parasite is most often met with in sheep, but also occurs in cattle, pigs, and goats.

Judgment.—If sarcocysts are generalized in the musculature and visible to the naked eye the entire carcass and all the organs shall be condemned. (Memo. 62, Foods, Sec. V *A* 28.)

Pentastomum.—The adult *Pentastomum tænoides* occurs in the nasal and frontal sinuses of the horse, dog, goat, and occasionally man. The parasite is a worm-like member of the Arachnida family, and the adult measures about three inches long. The body is shaped like an Indian club, and the head is provided with four hooks, two on either side of the mouth, by which the parasites attach themselves to the mucous membrane of the nasal cavities.

The eggs of the pentastomum pass out on to pasture and are ingested by horses, goats, sheep, hares, or even by cattle. From the eggs the larvæ escape and bore their way into the viscera of the abdomen and thorax of the host, where they become encysted. The larvæ are about $\frac{1}{5}$ of an inch long, are white and pear-shaped, and are covered with spine-like bristles by means of which they burrow into the tissues of their host.

The encysted embryos are most commonly seen in the mesenteric glands and liver, and less frequently in the lungs. They appear as small lesions about the size of a pea, of yellowish green or grey colour, and may be mistaken for tuberculous foci. The pentastome lesions are, however, all of one age and colour, and, when examined under the microscope, hooklets of the parasite are seen.

The embryos remain encysted in the tissues of the organs for a period of several months (about seven or eight) and thereafter bore their way into the body cavities of their host and migrate to the nasal cavities, or are passed out with the fæces.

EXTERNAL PARASITES OF ANIMALS OR ECTOZOA

The external parasites of animals include those which merely live on the host, those which penetrate the skin, and those which lay eggs on the outside of the body and whose larvæ develop in the tissues under the skin.

Fleas.—There are many kinds of flea which are parastic to animals. *Pulex irritans*, the human flea, occurs on some animals; there is also a flea peculiar to the dog, cat, rabbit and hen. Fleas cause irritation and,

when very numerous, the animals infested become poor in condition from interference with rest.

Lice are flat wingless insects which infest mammals and birds. Some exist on the debris of the skin; others bite and suck the blood of their hosts. Bird lice are of the former type, and cause poorness of condition through irritation. The " red louse " of the sheep is of the same type, and is responsible for serious loss of condition. The sheep become restless and a broken fleece may result from constant rubbing.

The blood-sucking lice are parasitic to all domestic animals. The pig louse is very large and is responsible for serious skin irritation and scabbing. Pigs lose condition when badly infected as they cannot rest or feed because of the irritation.

Mites or Acaridæ cause scab or mange in animals. Three forms of mange are distinguished, namely: Sarcoptic, Psoroptic, and Symbiotic.

The sarcoptes are small oval insects with hairs on body and legs. They have eight legs and some of these have suckers upon them. They burrow under the skin and lay eggs in the burrows. Sarcoptic mange occurs on those parts where the hair is thin, on the head and around the eyes.

The psoroptes are larger and longer than the sarcoptes and have legs which project beyond their bodies. They do not burrow, but bite and live on the debris of scabs and sores set up by the irritation and scratching caused by their presence. Psoroptic mange is found on the body principally and on the neck and around the tail; in sheep it is seen on the shoulders, back, and thighs.

The symbiotes have broad heads and are midway in size between the other two forms. Symbiotic mange is confined to one spot more or less, and is found round the tail or on the coronals.

Another mite may be included in this group, namely, the *Demodex folliculorum*, a worm-like mite with blunt head, which has four pairs of legs attached to the thorax. This mite burrows under the skin, causing a condition resembling acne in man. It affects the hair follicles and is most common on the snout and under parts of the body.

In the horse all kinds of mange are common; in cattle psoroptic mange is common, the others rare; in sheep psoroptic is most frequent, giving rise to " sheep scab "; while in pigs both sarcoptic and demodiac mange are common.

In all types of mange there is emaciation from irritation and interference with rest and feeding. In the symbiotic and psoroptic forms there is more or less serious scabbing and matting of hair and there may even be pustule formation. The affected animals rub against posts and turn round and nibble themselves. In sheep the fleece presents a ragged appearance, the skin shows the presence of scabs and bald places where the integument is thickened, and, in the later stages, deep ulcers or sores may occur.

A definite diagnosis can be made if a portion of the scab be examined under the microscope, when the acari may be identified, or by placing part of the scab on a piece of black paper near a fire, when the acari may be seen, with the unaided eye, moving toward the warmth.

As all forms of mites are capable of living for some weeks without a host, danger of infection from infected premises must be borne in mind.

The butcher may contract the disease as a result of contact with infected animals, but the eating of flesh of infected animals cannot give rise to the disease.

Judgment.—Sheep Scab and Parasitic Mange are notifiable under the Diseases of Animals Acts (see Memo. 62, Foods, *A*). The flesh and carcass need only be condemned where there is associated emaciation.

Bots and Warbles.—Bot flies affect several of the domestic animals, but the most common is that of the sheep, the *Œstris ovis.* The flies lay their eggs in the nostrils of the sheep, from which maggots develop; these have hooks on their mouths, and spines, by means of which they penetrate the mucous membrane of the nose, and enter the nasal and frontal sinuses. They give rise to great irritation and profuse discharge, and the infected sheep become restless and emaciated. The mature larvæ eventually escape and fall from the nostrils. The head of the sheep may be rendered useless for food when it is heavily infested with the parasite.

Warble flies also give rise to maggots; the grub of the *Hypoderma bovis* is common in cattle. The warble fly lays her eggs on the hairs of the legs, particularly the hind-legs; the maggots pierce the skin and wander along till they reach the gullet, where they develop and ultimately enter the subcutaneous tissue of the back. There they form swellings about the size of a pigeon's egg, in which the grub lives and feeds upon the fluids, formed through the irritation caused by their presence in the tissues. They breathe through a central hole in the swelling and through this they make their escape from the host's body.

Warbles generally appear on the back, under the skin, during the months of March and April. If the warbles are numerous the hides may be spoiled, and the flesh, known as "licked flesh", becomes a dirty green colour within a few hours of slaughter.

Judgment.—As a rule the condition is removed in the skin, but, when the deeper structures are involved, the affected portions should be cut out, the remainder of the carcass being allowed to pass if found to be in a fit condition.

Maggots.—Certain flies deposit their eggs on sores or raw skin surfaces. These develop into maggots or small slug-like grey larvæ of about half an inch in length. The flies most commonly met with are of two groups, "green bottles" or lucilia, and "blue bottles" or calliphora.

The sheep is most frequently infested, and the *Lucilia sericata* is responsible for serious maggot disease in sheep. The site most commonly affected is that of the moist areas around the eyes and anus, or any wound

on the body of the animal serves as a suitable site for deposition of eggs. There is constant movement of the tail and the animal bites at the infected area because of the intense irritation. Ulceration, inflammation, and oozing of offensive discharge may result.

Maggots occur also in dead meat; the fly responsible lays its eggs on the meat, and larvæ, or maggots, result. The ordinary " house fly ", *Musca domestica*, and the " blow fly ", *Musca vomitoria*, deposit their eggs on both fresh and decomposing meat, and even in sores, but the " flesh fly " or *Sarcophaga carnaria* lays eggs on decomposing meat almost exclusively.

Ticks are blood-sucking parasites of the family *Ixodidæ*: they are temporary parasites and no less than three hosts are required to complete the life cycle of some ticks.

The adult tick measures about ½ inch in length and has a bladder-like body, to which are attached four pairs of legs. All ticks bore or bite into the skin of their hosts and suck their blood by means of powerful sucking apparatus; when engorged they drop off on to the pastureland. The female lays eggs which develop into six-legged larvæ known as " seed ticks ", which in turn reach a host by means of the grass. They bite through the skin, engorge themselves with blood, and fall off. They then moult and become ticks with eight legs called " nymphs ". The nymph moults and becomes a mature tick and, after mating, the female tick continues the cycle.

If heavily infested with ticks, an animal becomes poor in condition owing to the constant irritation and disturbance with rest and feeding. But the main danger from ticks is the possibility of their acting as carriers of cattle diseases such as Texas Fever and Red Water Fever.

Pastures infected with cattle ticks should be used for sheep until clean. Dipping of infected sheep aids eradication of ticks.

A ked (*Melophagus ovinus*) is common in sheep and is often mistaken for a tick. It also sucks the blood of its host and may be responsible for irritation and poorness of condition.

PIROPLASMOSIS

Certain members of the tick family are capable of transmitting disease from one animal to another by introducing minute piroplasms into the blood of their host through a bite. Texas fever is caused by a piroplasm which is introduced into cattle by the bite of a tick found in America and Australia, and the piroplasm of red water fever is introduced into the blood of cattle in this country by a tick which acts as its carrier.

Texas Fever or " tick fever " is never seen in this country. It occurs in America, Australia, and Finland. The blood parasite which gives rise to the disease is known as the *Pyrosoma bigeminum*, and is carried through a tick. The disease is very deadly to cattle, but sheep are immune, and human beings have never been known to become infected.

In acute cases the animal suffers from high fever, becomes anæmic and even jaundiced, and may pass blood-stained urine. The animal may die in a few days and the flesh shows signs of acute fever, while the mucous membranes show hæmorrhages. In less acute cases the animal becomes emaciated and dropsical, the liver and spleen become enlarged, and hæmorrhages may be seen in many of the internal organs. Examination of the blood under the microscope shows evidence of the characteristic piroplasm.

Red Water Fever is akin to Texas Fever, and takes its name from the characteristic symptom of red-coloured urine. It is caused by a piroplasm introduced into the blood of cattle in this country by a tick, usually the *Ixodes ricinus*.

The illness may be acute, with sudden onset of high fever accompanied by shivering, loss of appetite, severe constipation generally followed by diarrhœa. The urine may be dark or bright red, containing broken-up blood corpuscles and free hæmoglobin. The disease may be more chronic, resulting in anæmia and poorness of condition. It is responsible for great loss of condition in milk cows in some parts of Devon and Cornwall.

The condition is most common from March to June and from October to November, at the times when adult ticks are most prevalent. The carcasses of cattle infected with red water fever are pale, blanched, and dropsical; the flesh is of a dirty colour and is wet, and there may be staining with bile, particularly in the fatty tissues. The spleen is very much enlarged and there is congestion of all the internal organs, particularly of the liver.

Judgment.—If there is evidence of pronounced anæmia, general pathological emaciation or dropsy, the carcass and all the organs must be condemned. (Memo. 62, Foods, Sec. V *A* 2, 9, and 10.)

APPENDIX A

NOTES ON BACTERIOLOGY

In cases where there is doubt as to the true nature of a disease from the naked-eye appearances alone, a bacteriological examination will frequently be found useful in settling the diagnosis. For this purpose the following rough-and-ready method will be found useful to the meat inspector.

A platinum wire fixed on a glass holder and with a loop at its free extremity, also some glass slides, are required for the purpose. If it be a fluid that requires investigation, first sterlize the platinum wire by holding it in a Bunsen or spirit-lamp flame till it turns red-hot, then wait for a moment till it cools. It is next dipped in the fluid to be examined, and then rubbed over the slide so that a thin film of fluid is deposited upon the glass surface. The slide is then held over a very small Bunsen flame till the fluid upon its surface becomes dry, after which it is rapidly passed three or four times through the flame in order to fix the film. It is now ready for staining. Films of blood, pus, or milk should not be subjected to heat, but should be immersed in equal parts of alcohol and ether for fifteen to twenty minutes in order to fix them.

In examining diseased tissues or solid parts, if they be moist, the plantinum loop is passed over the affected surface several times, and then the material that adheres to it is rubbed up with a small drop of water previously deposited upon the slide. In this manner an emulsion is obtained which should be spread out as evenly as possible, and dried and fixed as above. Another method is simply to rub the slide itself over the affected tissues, in which manner a film is obtained.

In dealing with lesions of a firm and dry consistence it is better to remove a small piece, crush it up with water in a watchglass, and make a film from the emulsion so obtained.

Staining.—For ordinary purposes, the basic aniline dyes may be employed for staining.

Method.—Pour sufficient of the selected stain over the slide so as to completely cover the film which it is desired to stain; leave it on for a time varying with the particular stain chosen, thus:

Löffler's methylene blue	10 min.
Aniline gentian violet	2 „
Carbol fuchsine	1–2 „

The fluid stain is then washed off with water, when the film will be found stained. The excess of water may then be removed by drying between

folds of filter paper, or by gentle warming over a very small flame, or it may be left to dry spontaneously.

The above three basic aniline stains will stain most of the ordinary bacteria; certain organisms, however, require special methods of staining in order to bring them out; such methods will be described when dealing with the organisms in question.

Gram's Stain.—Gram's method of staining is used as an aid to the diagnosis of a large number of micro-organisms.

Method.—(1) Stain in aniline oil, gentian violet for 5 minutes; (2) wash in water; (3) treat the film with Gram's iodine solution till it becomes purplish black in colour; (4) counterstain for a few minutes with eosine; (5) decolourize with absolute alcohol or methylated spirit till colour has almost entirely disappeared; (6) wash in water, dry, and examine. Organisms which retain the stain after this process are said to retain Gram's stain, and those which lose it are said to be decolourized.

Microscopic Examination of Bacteria.—For bacteriological work a good microscope is essential. It should be provided with rack and pinion and fine adjustment, a double mirror, flat on one side and concave on the other, and a good condenser with an iris diaphragm. It is best to have a low-power objective two-thirds of an inch, a high-power objective one-sixth of an inch, while an oil-immersion or one-twelfth-inch lens is essential.

When examining stained bacteria, the flat side of the mirror should be used and the diaphragm should be widely opened. A drop of cedar oil having been put upon the film, the slide is put in its place and the oil-immersion lens lowered by the coarse adjustment till it becomes immersed in the oil. The specimen is then carefully focussed by the fine adjustment, when the character of the organism is made out.

MICROSCOPICAL APPEARANCE OF THE VARIOUS BACTERIA

Tubercle bacilli appear under the microscope as straight or slightly curved rods, thin in proportion to their length, measuring 2·5–3·5 μ in length, and 3 μ in thickness. Their arrangement in the tissues is somewhat irregular; they may occur singly or in pairs, or may be groupied together in little masses. It is quite common for a tuberculous lesion to be examined and few or no bacilli found.

They generally stain uniformly, but may present small uncoloured spots with darkly stained parts between.

Staining.—The tubercle bacillus may be distinguished from most other organisms by the fact that it is " acid fast ", that is to say, that when stained with carbol fuchsine it retains the red colour after treatment with a strong mineral acid—Ziehl-Nielsen stain.

Method.—(1) Pour some carbol fuchsine over the film, heat over a flame till steam rises, allow stain to remain on for 5 minutes; (2) decolourize with 20-per-cent solution of strong sulphuric acid; (3) wash well in water till preparation regains a faint pink colour; (4) counterstain in methylene blue for 1 minute; (5) wash, dry, put on a drop of cedar oil, and examine with the oil immersion.

Tubercle bacilli retain Gram's stain.

Actinomyces.[1]—The colonies of this parasite are made up of three morphological elements: filaments, cocci, and clubs. The filaments are generally found in the centre of the colony. They are thin structures, and interlace with one another to form an irregular network; sometimes the protoplasm of the filaments is broken up into little rounded bodies like cocci. The clubs are elongated pear-shaped bodies formed by a swelling of the sheath at the free extremity of a filament.

In actinomycosis from slaughter-house animals, the clubs are generally the most prominent feature, it being perhaps impossible to find any filament in the colonies. Sometimes the colonies are found to have undergone calcification.

Examination.—Take one of the colonies, which can be recognized by the naked eye as a small yellow granule, wash it in salt solution and examine it, unstained, under the microscope, when the clubs, if present, are readily seen. Or, a colony may be broken down in a little water on a glass slide, dried, and stained by one of the three stains given at the beginning of this section.

The fungus of actinomycosis is positive to staining by Gram's method.

Actino-bacillosis.—The granules consist (when examined microscopically) of masses of radiating clubs, but there are no filaments. Bacilli can be demonstrated by staining with carbol fuchsine or methyl-violet, but they do not retain the stain by Gram's method.

Bacilliary Necrosis, Organisms of.—This subject has been investigated by M'Fadyean, who described the bacillus. It is composed of rods and long unsegmented threads. Coccus forms are also said to occur, but it is not certain that they are a form of the same microbe. The organism is found in the living tissues just beyond the dead area; it stains well by Löffler's methylene blue.

Swine Erysipelas is due to a non-motile bacillus with rounded ends measuring ·8–1·5 μ long and ·1–·2 μ wide. It stains equally throughout by the basic aniline dyes and by Gram's method. Smears are best made from the lymphatic glands, spleen, or bone marrow.

Anthrax.—The bacilli are about 1·2 μ thick and 6–8 μ long. Their ends are cut squarely across. Around their protoplasm a thin unstained capsule may be seen. The bacilli are frequently found lying end to end,

[1] *A Preliminary Report on the Pathology of Bovine Actinomycosis*, by F. Griffith, M.B. (Food Report No. 23), issued by the Local Government Board, 1915. Price 2*d*.

thus forming a chain. The organism stains well with the basic aniline dyes and is not decolourized by Gram's method.

Malignant Œdema.—This bacillus is an anærobic organism, measuring from 3–10 μ long and 1 μ in thickness. It occurs in the form of motile rods, which may, under suitable conditions, form spores situated at the centre of the organism. The organism may be readily stained by any of the basic aniline stains; it is decolourized by Gram's method in old cultures.

Black Leg.—The bacillus which gives rise to this disease closely resembles that of malignant œdema. It is, however, somewhat thicker.

Louping Ill.—The bacillus of this disease is found in the intestinal canal and peritoneal liquid. It is a large coarse-looking rod, sometimes occurring in chains, and varying somewhat in size. Its ends are rounded and it possesses slight motility. It may form spores, which are situated at the centre or at one end.

Braxy.—The bacillus is distinguished from all others of its class by its small size. It forms a small brown, highly refractile spore, generally located near the end of the rod. Chromatic granules are present in the bacillus, which give it an irregular appearance even in unstained preparations. The organism stains well with methylene blue and with carbol fuchsine.

Bacillus coli is a motile non-sporing rod varying from ·8 μ–1·5 μ in length and about ·4–·5 μ in thickness. It stains by the ordinary aniline dyes and is decolourized by Gram's method.

Staphylococcus pyogenes aureus is a spherical body about ·9 μ in diameter, which grows in irregular masses or clusters.

Staphylococcus pyogenes albus is exactly similar, with the exception that it produces a white growth on nutrient media instead of a yellow, as does *Staphylococcus pyogenes aureus.*

Streptococcus pyogenes is a coccus about 1 μ in diameter which forms chains of varying lengths.

The above three organisms stain readily with the basic aniline dyes and retain Gram's stain.

Bacillus pyocyaneus gives rise to pus of a bluish colour. It occurs in the form of minute rods 1·5–2 μ in length and less than ·5 μ in thickness, which are motile but do not form spores.

It stains readily with the basic aniline stains, but is discoloured by Gram's.

Bacillus Botulinus is of considerable size, measuring 4–9 μ in length and ·9–·2 μ in thickness; it has somewhat rounded ends and is sometimes seen in spindle form. It may be arranged in pairs or in short threads. It is a motile organism with 4–8 lateral flagella of wavy form. It stains with the ordinary dyes and retains Gram's stain, though care must be employed in decolourizing. It is an anærobic organism, i.e. it will only grow when no oxygen is present.

APPENDIX B

DISEASES FOUND IN THE TISSUES AND ORGANS OF CATTLE, SHEEP, AND PIGS

Head.

BRAIN.—Cysts of *Cœnurus cerebralis* (sheep and cattle).
JAW.—Actinomycosis: nodules and ulceration.
CHEEKS.—*Cysticercus bovis* (cattle).
TONGUE.—Glossitis (inflammation).
Actinomycosis: nodules, ulcers, and " wooden tongue ".
MUCOUS MEMBRANE OF THE MOUTH.—Ulceration in glanders, and foot-and-mouth disease (lips also affected).
PALATE.—Actinomycosis: nodules and ulceration.
ŒSOPHAGUS.—Actinomycosis: nodules and ulceration.
Papillomata: " angle berries " in cattle.
Sarcocysts.

Lungs.

Tuberculosis: inflammation, tubercles, caseation, calcification.
Pneumonia: Bacterial—pneumoccus, streptococcal, Caseous lymphadenitis, contagious pleuro-pneumonia of cattle.
Parasitic—strongylus, liver fluke.
Fungoid—aspergillus.
Melanosis.
Cysts: hydatid (very commonly seen).
Stomach contents: through aspiration during slaughter, also blood.

Trachea.

Tuberculosis: on the lining membrane.

Heart.

Tuberculosis: very rare in the muscle, may occur in the pericardium in advanced cases.
Enlargement: common in many diseases.
Fatty degeneration.
Ulceration of the valves: in septic conditions and rheumatism.
Vegetative endocarditis.
Erysipelas: in pigs.
Cysts: hydatid, *Cysticercus bovis* (cattle), *Cysticercus cellulosæ* (pigs).
Pericarditis: Tuberculous, traumatic, rheumatic.

Stomach.

Tuberculosis.
Inflammation.
Ulceration.
Penetrating wounds.
Actinomycosis (rare).

Intestines.

Small and Large.—Tuberculosis: in young pigs and more rarely calves.
Inflammation.
Ulceration.
Actinomycosis.
Round worms (very common).

Small Intestine.—Ulceration: swine fever. and *Echinorrynchus gigas*.
Congestion: cattle plague.
Hæmorrhages: louping ill of sheep.
Nodules: pimply gut.
Corrugation: Johne's disease.

Large Intestine.—Ulceration: swine fever ulcers in the cæcum.

Liver.

Tuberculosis: nodules, caseation, calcification common in all animals except sheep.
Fatty degeneration.
Melanosis.
Hepatitis (inflammation) acute, chronic, suppurative.
Cirrhosis (chronic interstitial hepatitis).
Fluke disease (enlarged bile ducts).
Congestion in many diseases also with pentastomum.
Milk spots.
Capillary angiomata.
Bacillary necrosis.
Acute yellow atrophy.
Abscesses: single, multiple (in sepsis and joint ill).
Cysts: hydatid, *Cysticercus tenuicollis*.
Caseous lymphadenitis (foci of caseation but never calcification).

Spleen.

Tuberculosis: peritoneal surface affected in cattle (splenic substance in pigs).
Inflammation.

Enlargement: splenic leukæmia, caseous lymphadenitis, red water fever, anthrax (very great and spleen substance tarry).
Hæmorrhages: in many diseases.
Sarcomata: often melanotic.
Hydatids.

Kidneys.

Tuberculosis: common.
Inflammation: acute, chronic, purulent, and fibro-plastic.
Cloudy swelling: in febrile diseases.
Fatty degeneration: in chronic diseases.
Caseous lymphadenitis.
Hydatids: rare.

Uterus.

Tuberculosis: common in all stages.
Inflammation: simple, septic.

Udder.

Tuberculosis: common.
Injury.
Inflammation: garget, mastitis.
Abscesses: single, multiple.
Actinomycosis: common in pigs, but rare in cattle.

Bones.

Tuberculosis: common in dorsal vertebræ, sternum, and ribs of pigs.
Fractures.
Rickety deformity.
Osteomyelitis (milky marrow).
Jaundice (yellow marrow).
Melanosis.
Cysts: hydatid (rare).
Sarcomata.
Carcinomata.

Joints.

Tuberculosis.
Inflammation: simple, septic, joint ill.
Rheumatism: thickening of tissues and enlargement of the joint.

Connective Tissue.

Tumours: fibromata, lipomata, sarcomata, carcinomata.
Sarcocysts.

Cysts of *Cysticercus cellulosæ* in pigs.
Onchocerciasis in cattle from Australia.
Melanosis.

Muscles.

Tuberculosis: seldom, if ever, seen.
Bruising and injury.
Myositis (inflammation).
Myomata.
Sarcocysts.
Trichina spiralis: in pigs.
Cysticercus bovis (cattle).

Glands.

Tuberculosis: enlargement, caseation, calcification.
Sepsis: enlargement, caseation, but never calcification.
Carcinomatous enlargement.
Leukæmia: enlargement.
Swine fever: enlargement with " strawberry " appearance.
Pentastomum: mesenteric glands affected.
Johne's disease: enlargement.

Serous Membranes.

GENERAL.—Tuberculosis: very common, causing " pearl disease ".
Sepsis: simple, suppurative, hæmorrhagic adhesions resulting from inflammation.
Cysticercus tenuicollis.
PLEURA.—Fibrinous pleurisy: in contagious pleuro-pneumonia of cattle.
Hæmorrhagic pleurisy: in injury, anthrax, and red water fever.
PERITONEUM.—Hydatids: rare.
Peritonitis acute, chronic, septic, tuberculous.

Skin.

Erysipelas: " diamond disease " in pigs.
Ringworm.
Worts.
Ulcers: actinomycosis, farcy, bots, and warbles.
Purple-red eruption: in swine fever.
Mange: scab from various acari.
Maggots.
Ticks.
Subcutaneous Œdema: anæmia, fluke disease, kidney disease.

DISEASES PECULIAR TO AND MORE FREQUENT IN CERTAIN ANIMALS

Glanders.

Confined almost exclusively to the horse and equine animals.

Cattle Plague. **Red Water Fever.** **Onchocerciasis.** **Cysticercus bovis.**	Cattle Diseases.

Louping Ill. **Braxy.** **Caseous Lymphadenitis.**	Diseases of the Sheep.

Swine Fever. **Swine Erysipelas.** **Swine Plague.** **Trichinosis.** **Cysticercus cellulosæ.** **Echinorrynchus gigas.**	Diseases of the Pig.

Sheep and Goats are practically immune from **Tuberculosis.**

The Pig is rarely, if ever, infected with

Anthrax.
Caseous Lymphadenitis.
Black Quarter Ill.
Glanders.
Johne's Disease.

Section III.—Inspection of Live Animals and Inspection in the Slaughter-house

CHAPTER I

General Considerations

Meat Inspection—Powers under which Inspection is made—Meat Inspectors—Memorandum 62, Foods—Meat Inspection in Scotland—Classification according to Age and Sex of the Animal.

MEAT INSPECTION

In England and Wales [1] the system of meat inspection is based on the provisions of the Public Health (Meat) Regulations, 1924, and on a system of Meat Inspection recommended by the Ministry of Health for adoption by Local Authorities and their officers (Memo. 62, Foods). Seizure of diseased, unsound, or unwholesome meat is effected by the powers granted by Sections 116–119 of the Public Health Act, 1875.

Public Health (Meat) Regulations, 1924.—These regulations contain certain very important provisions designed to facilitate the inspection of meat in private slaughter-houses, which, under the general law which is extended to rural districts by the Rural District Councils (Slaughter-house Order), 1924, must be registered or licensed by the Local Authority.

Notice of Slaughtering must be given.—Unless it is the practice in any slaughter-house to slaughter at fixed times or on fixed days, and written notice to this effect has been given to the Local Authority, it is unlawful for a person to slaughter an animal for sale for human consumption, either in a slaughter-house or elsewhere, unless he has given to the Local Authority at least three hours' notice of the day and time of the proposed slaughtering. In the case of emergency slaughter rendered necessary as a result of accident, injury, illness, or exposure to infection, it will suffice if notice is given as soon as reasonably possible.

[1] As the system of inspection in Scotland differs somewhat from that in England and Wales, notes on the procedure adopted in the former country appear on p. 171.

Notice of Disease must be given.—If it appears that any part of the carcass or internal organs of an animal is or may be diseased or unsound, it is the duty of the person by whom, or on whose premises, the animal was slaughtered, to give notice of the fact to the Local Authority.

Carcass must be retained for Inspection.—As a general rule the carcass of an animal, including the mesentery and internal organs other than the stomach and bladder, may not be removed from the place of slaughter until it has been inspected, or its removal has been authorized by an inspector of the Local Authority. As the danger from disease in sheep is relatively small, this rule does not apply in their case, nor to animals slaughtered in slaughter-houses at regular times, of which notice has been given to the Local Authority, unless in either case the carcass or organs appear to be diseased or unsound.

There is a further proviso to the general rule, namely, that, whether or not the carcass has been inspected, it may be removed from the slaughter-house at the expiration of three hours from the time of slaughter, or six hours from the time of delivery of the notice of slaughtering, whichever time may be later (see p. 415).

The object of the above provisions is to ensure that the inspector shall have the opportunity of being present at the time of slaughter, or of examining the carcass and organs before their removal from the place of slaughter. In many districts, however, the inspector will be unable to be present at all slaughterings, or to inspect all carcasses; the duty is therefore placed upon the person " by or on whose behalf " an animal is slaughtered to give notice to the Local Authority if " it appears that any part of the carcass or internal organs is or may be diseased or unsound ".

INSPECTION

Inspection may be divided into two parts, namely, inspection of the living animal (ante-mortem inspection) and inspection of the carcass and organs. The Recommendations of the Ministry of Health contained in Memo. 62, Foods, are an invaluable guide, and, as an intimate knowledge of their contents is expected of every meat inspector, the memorandum appears in full (p. 164).

It will be noted that the first section deals with ante-mortem inspection, the duties of butchers and slaughtermen, and contains

general instructions to meat inspectors. Thereafter the method of examining carcasses with instructions as to the action to be taken if tuberculosis or other specified diseases is present, are set out.

Though the Recommendations are not statutory, they have been generally adopted throughout England and Wales and are a great advance on any previous pronouncement made on the subject.

In Scotland a very similar code of direction has been incorporated in the Public Health (Meat) Regulations, Scotland, 1932, and, being statutory, they must be complied with.

Qualifications of Meat Inspectors.

Under Section 116 of the Public Health Act, 1875, any Medical Officer of Health or Sanitary Inspector may at all reasonable times inspect any animal, carcass, or meat exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and intended for the food of man (see p. 418).

Section 131 of the Towns Improvement Clauses Act, 1847, authorizes the "seizure" of meat which appears unfit for the food of man, not only by the Medical Officer of Health and Sanitary Inspector, but also by any other officer appointed by the Council for the purpose. Thus the power of seizure may be exercised by a veterinary inspector appointed by the authority to inspect meat.

The term "inspector" as used in the Public Health (Meat) Regulations, 1924, means the Medical Officer of Health or Sanitary Inspector or other officer of a local authority having power to inspect or examine meat.

The inspection of meat and other foods and the superintendence of the hygiene of food production and preparation forms a very important branch of public health work which is generally carried out, under the supervision of the Medical Officer of Health, by Sanitary Inspectors, a large and ever increasing number of whom possess the Food Inspector's Certificate of the Royal Sanitary Institute. Such certificated Sanitary Inspectors generally make very competent food inspectors. They possess as a rule, by training and experience, the requisite sound practical knowledge of the subject, and display much ability, tact, and judgment in the performance of their responsible duties.

MEAT INSPECTION

MEMORANDUM ON A SYSTEM OF MEAT INSPECTION RECOMMENDED BY THE MINISTRY OF HEALTH FOR ADOPTION BY LOCAL AUTHORITIES AND THEIR OFFICERS. (Memo. 62, Foods.)

GENERAL OBSERVATIONS FOR THE GUIDANCE OF INSPECTORS AND BUTCHERS.

[1] A.—Ante-mortem Inspection.

Where practicable it is desirable that all animals should be inspected before slaughter, the object being to ascertain that each animal which it is intended to slaughter is in a satisfactory state of health. In cases of doubt as to the healthiness of the animal the meat inspector should notify the veterinary inspector, if one has been appointed for that purpose, and his instructions should be observed. Where ante-mortem inspection of animals is not practicable or has not taken place, the butcher should notify the meat inspector or medical officer of health in any case in which he has doubt as to the healthiness of any animal, who should take immediate steps to have the animal examined before slaughter.

B.—Duties of Butchers and Slaughtermen.

(i) Evidence of disease in a carcass should not be modified or obliterated by washing, rubbing, stripping or in any other manner, except under the direct supervision of the meat inspector and in accordance with his instructions.

(ii) In no case either of " back bleeding ", " over-sticking " or " sticking-in " should stripping of the serous membrane be permitted, except by or under the direction of the meat inspector, and in any such case in which immediate stripping is necessary to preserve the marketability of the carcass the membrane should not be entirely detached from the carcass until it has been examined by the meat inspector and he has authorized the detachment.

(iii) Notification of intention to slaughter animals *for emergency reasons* should be forwarded to the veterinary inspector, meat inspector or medical officer of health, and so far as practicable all such animals should be examined at the time of slaughter. If not so examined the carcass and the whole of the viscera should

[1] It should be noted here that, in accordance with the provisions of the Diseases of Animals Acts and Orders made thereunder, every person having in his possession or under his charge an animal affected with, or suspected of being affected with anthrax, cattle plague, pleuro-pneumonia, foot-and-mouth disease, sheep pox, sheep scab, swine fever, epizootic lymphangitis, glanders and farcy, rabies or parasitic mange, tuberculosis of the udder, indurated udder or other chronic disease of the udder, tuberculous emaciation, chronic cough and showing definite signs of tuberculosis, is required to give notice of the fact to a constable of the police force for the police area. The meat inspector should immediately transmit any information of a similar nature coming within his knowledge to a constable or to the inspector of the Local Authority under the Diseases of Animals Acts.

be detained until it has been examined by the meat inspector and a decision given.

In cases where such an animal is examined at the time of slaughter, the inspector may require the carcass and the whole of the viscera, unless obviously unfit for food, to be detained for 24 hours thereafter to enable a later inspection to be made.

All carcasses of such animals as may subsequently be passed for human consumption should be ribbed or quartered before being released.

(iv) When any dead or moribund animal is admitted into a slaughter-house, immediate notification of the fact to the veterinary inspector, meat inspector or the medical officer of health should be made by the owner or person in charge of the animal, and as soon as practicable after receipt of the notification an inspector should examine such carcass or animal.

(v) Tuberculous carcasses or carcasses presenting lesions of other disease should not be wiped down with the ordinary wiping cloth, and the cloth that has been used for such purpose should not again be used until it has been boiled for 15 minutes in water containing soda.

(vi) Where the carcass has not been examined by the meat inspector at the time of slaughter, the whole of the viscera and offal should be kept, pending inspection, in such a way as to enable them to be identified, by labelling or otherwise, with the carcass from which they have been removed.

C.—General Instructions to Inspectors.

(i) Every effort should be made to inspect the carcasses and viscera of all animals slaughtered within the area.

(ii) Knives that have been used for cutting any diseased organ, gland or tissue should not again be used for any purpose until they have been disinfected in boiling water or other suitable disinfectant.

(iii) The carcass of an animal that is free from disease in the carcass and organs and which is well nourished, should be passed as fit for human consumption.

(iv) When all diseased portions have been removed from a carcass under the supervision of a meat inspector in accordance with the instructions below, the remainder of the carcass should be passed as fit for human consumption.

(v) If disease is found in any part of a carcass or in any organ, the whole carcass and all the organs should be examined for evidence of any repetition of the local condition, or modification thereof in other parts, according to the following plan.

D.—Method of Examination of Carcasses.

The following instructions indicate the order and method of inspection of all carcasses:

Section I.—General Principles to be observed.

1. *Viscera.*

(*a*) All viscera shall be examined as they are removed from the carcass, or in such circumstances as will ensure that they are the viscera of a particular carcass.

(*b*) Every organ and the associated lymph glands shall be examined by the eye and by palpation. When any abnormal condition is observed, the nature and significance of which cannot be determined by such examination, the organ and/or gland shall be incised and the incisions shall be made in such manner as to avoid soiling or contaminating or unnecessarily depreciating the value of any part of the carcass or other organs that may be passed as fit for human food.

(*c*) The efficient examination of lymph glands shall be by multiple incisions into their substance.

2. *Carcass.*

(*a*) The carcass shall be examined for (1) condition of nutrition; (2) evidence of bruising, hæmorrhage or discolouration; (3) local or general dropsy (œdema); (4) the efficiency of bleeding; and (5) swellings or deformities of bones or joints or swellings or other abnormality in the musculature.

(*b*) The serous membranes (pleura and peritoneum) shall be examined in every case, and in no case shall they be removed nor shall any evidence of disease be modified or obliterated by washing, rubbing, stripping, or in any other manner before examination.

(*c*) After the carcass is split, the sternum, ribs, vertebræ and spinal cord shall be examined.

Section II.—Detailed Instructions for Routine Inspection of Carcasses of Bovines and Swine.

1. *Head.*

The head, including (*a*) the surface and substance of the tongue (which shall be loosened but not detached before examination), (*b*) the palate or roof of the mouth, and (*c*) the lymph glands of the throat (retropharyngeal, submaxillary and parotid), shall be examined, and the cheek muscles shall be examined by a linear incision parallel to the lower jaw.

2. *Abdominal Cavity.*

(*a*) *Stomach, Intestines and Spleen.*—The outer, and when necessary the inner, surfaces of the stomach and intestines, and the surface and substance of the spleen shall be examined, together with the glands of the stomach and bowel (gastro-splenic and mesenteric) and the web (omentum).

(*b*) *Liver.*—The surface and substance of the liver shall be examined. The associated glands (hepatic) shall also be examined and the bile ducts incised where necessary.

(*c*) *Kidneys.*—The lymph glands of the kidneys (renal) and the adrenal glands shall be examined before the removal of the kidneys. Thereafter the kidneys shall be exposed, and the surface examined and, if necessary, the kidneys shall be split by incision and the substance examined.

(*d*) *Uterus and Ovaries.*—The inner and outer surfaces of the uterus, and the substance of the ovaries shall be examined.

[NOTE.—In reporting upon lesions included in paragraphs 2 (*a*), 2 (*b*) and 2 (*d*), special attention shall be paid as to whether the lesions affect the peritoneal surface or the organ itself. Unless care in this connexion is evinced statistical records become misleading.]

3. *Thoracic Cavity.*

The pluck shall be examined before the various organs are separated from each other, and the following examination shall be made:

(*a*) *Lungs.*—The lungs shall be examined by observation and by palpation, and, unless obviously diseased, they shall be incised at the base. The associated lymph glands (bronchial and mediastinal) shall also be examined, and unless obviously diseased, shall be incised.

[NOTE.—In reporting upon lesions included in paragraph 3 (*a*), distinction should be made between lesions affecting the pleura and those affecting the lung substance (parenchyma).]

(*b*) *Heart.*—The heart sac (pericardium) shall be opened, and the heart examined and if necessary incised.

[NOTE.—In reporting upon lesions in paragraph 3 (*b*), distinction should be made between lesions of the pericardium, myocardium and endocardium.]

4. *Udder.*

The udder shall be examined by observation and palpation, incisions shall be made at the base of the teats, and also into any indurated region in the substance of the gland, and the associated glands (supra-mammary) shall also be incised.

5. *Testicles and Penis.*

The outer surface and the substance of the testicles and penis and the superficial inguinal glands shall be examined.

6. *Serous Membranes.*

The lining (serous) membranes of the chest and abdomen (pleura and peritoneum) shall be examined in every case.

[NOTE.—It will be observed that in *all* cases the following glands must be examined as a matter of routine, viz.: (1) Retropharyngeal (in bovines) and submaxillary (in swine); (2) bronchial and mediastinal; (3) hepatic and (4) mesenteric.]

Section III.—Instructions as to Additional Inspection where Evidence of Tuberculosis has been discovered in Bovines or Swine.

Where as a result of inspection in accordance with Section 2 evidence of tuberculosis has been detected, the carcass and viscera shall be examined in accordance with the following instructions:

1. The viscera and the associated lymph glands shall be examined for evidence of tuberculosis both in the substance and in the covering membranes (capsules). *The existence of tuberculosis in the lymph gland of an organ shall be held to be evidence of the disease in the organ.*

2. All the usual lymph glands which are examined in meat inspection work (other than those already enumerated), viz.: the lower cervical, presternal, suprasternal, sub-dorsal, prescapular, supra-mammary (or superficial-inguinal), iliac and sub-lumbar glands; and, if considered necessary, the precrural and popliteal glands shall be exposed and examined by incision in every case of tubercle. Those glands which, having regard to visible evidence, are least likely to be infected, shall be examined first, e.g. if evidence of tuberculosis is found on the pleura the glands of the hind-quarter shall be examined before those of the fore-quarter.

3. The carcass of a pig in which lesions of tuberculosis are found in any situation or in any degree shall be split and the vertebræ examined. The kidneys in such a carcass should be freed, but not necessarily detached from the enclosing fatty tissue, the surface should be carefully examined, and if lesions are obvious or suspected, incisions should be made into the substance.

Section IV.—Instructions as to Action to be taken in the event of Evidence of Tuberculosis being found in Bovines and Swine.

A.—*Organs.*

An organ shall be seized when tuberculosis exists on its capsule, or in its substance, or in the associated lymph glands.

B.—*Head.*

1. The head, including the tongue, shall be seized if any of the lymphatic glands of the head are affected.

C.—*Carcass.*

1. The entire carcass and organs shall be seized when the following conditions are found:

(*a*) Tuberculosis with emaciation.
(*b*) Generalized tuberculosis.

NOTE.—In determining whether the disease is generalized, the judgment shall be based on the sum of the evidence of disease throughout the entire carcass and organs. The following conditions shall be regarded as evidence of generalization:—

(1) Miliary tuberculosis of both lungs. (*Note.*—This regulation is subject to the following qualification:—In minor instances of miliary tuberculosis of the lung, without evidence of tuberculosis elsewhere and provided the miliary tubercles are not numerous and not of recent origin, it may be possible to pass the carcass. But miliary tuberculosis of the lung even in such a case is evidence of previous systemic infection, and the decision as to whether such a carcass should be condemned should devolve upon the veterinary inspector or the medical officer of health.)
(2) Where lesions are multiple, acute, and actively progressive.
(3) Where there is multiple and widespread infection of the carcass lymph glands.
(4) Where there are diffuse acute lesions of both serous membranes (pleura and peritoneum) and any of the carcass lymph glands are enlarged or contain visible tuberculous lesions.
(5) Where, in addition to the presence of tuberculous lesions in the respiratory or digestive tracts, there are also lesions present in the substance of any one of the following—spleen, kidney, udder (or uterus or ovary), testicle, brain and spinal cord or their membranes. (*Note.*—Notwithstanding this instruction instances may be found where it would be justifiable to pass the carcass after condemnation of the affected organ. Absence of signs of activity, such as calcification or definite encapsulation would be favourable indications. The decision as to whether such a carcass should be condemned should devolve upon the veterinary inspector or the medical officer of health.)
(6) Congenital tuberculosis in calves.

2. All cases of tuberculosis not included in the immediately foregoing regulation shall be regarded and treated as localized lesions, and the parts containing the lesions and contiguous thereto shall be condemned.[1]

3. If an organ or portion of a carcass becomes contaminated by tuberculous material, it shall be treated as if it were a case of localized tuberculosis.

[1] See footnotes on p. 170.

Section V.—Instructions as to action to be taken in the event of Evidence of other Disease being found in Carcasses of Bovines, Swine, Sheep or Horses.

A.—The entire carcass and all the organs shall be condemned if evidence of any of the following conditions is found:

1. Actinomycosis, generalized.
2. Anæmia (if pronounced).
3. Anthrax.[2]
4. Black leg.
5. Bruising, general, extensive and severe, with or without gangrene.
6. Cysticercus bovis (measly beef), if generalized in the meat substance.
7. Cysticercus cellulosæ (measly pork), if generalized in the meat substance.
8. Decomposition (general).
9. Dropsy, general.
10. Emaciation, general, pathological (associated with disease).
11. Erysipelas, acute swine.
12. Fever (acute).
13.[3] Foot-and-mouth disease.[2]
14. Glanders (or farcy).[2]
15. Immaturity, stillborn or unborn carcasses.

Immaturity.—A carcass shall be considered too immature to produce wholesome meat if—

(*a*) The meat has the appearance of being water-soaked, is loose, flabby, tears easily, and can be perforated with the fingers; or

(*b*) Its colour is greyish-red; or

(*c*) Good muscular development as a whole is lacking, especially noticeable on the upper shank of the leg, where small amounts of serous infiltrates or small œdematous patches are sometimes present between the muscles; or

(*d*) The tissue which later develops as the fat capsule of the kidneys is œdematous dirty yellow or greyish-red, tough and intermixed with islands of fat.

16. Jaundice.
17. Lymphadenitis, caseous.
18. Malignant catarrhal fever.
19. Malignant neoplasms—unless localized, in situation and effect, to one organ.
20. Mammitis, acute septic.
21. Melanosis, generalized—or any generalized pigmentation.
22. Metritis, acute septic.
23. Uræmia (or carcasses having a urinous odour).
24. Pericarditis, septic.
25. Pneumonia, gangrenous.
26. Pyæmia—including joint-ill, or umbilical pyæmia.
27. Rickets with malnutrition.
28. Sarcocysts—if generalized in the musculature and visible to the naked eye.
29. Septicæmia, or septic intoxication.
30. Swine fever.[2]
31. Tetanus.
32. Trichinosis.
33. Tumours, multiple in musculature.

[2], [3] See footnotes on p. 170.

B.—In all cases in which evidence of disease not enumerated in Instructions A above is found, the organ or portion of the carcass (or organs or portions of the carcass) affected by the disease, and the organs or portions contiguous thereto, shall be condemned.

MINISTRY OF HEALTH,
WHITEHALL, S.W. 1. *March*, 1922.

FOOTNOTES.—[1] It will be understood that this memorandum is concerned with the conditions under which meat should be condemned as unfit for human food The decision as to any legal action which may follow such condemnation rests, of course, with the Local Sanitary Authority

[2] See footnote on p. 164.

[3] The decision as to whether animals affected with this disease (foot-and-mouth disease) shall be slaughtered or otherwise disposed of rests with the officers of the Ministry of Agriculture and Fisheries. If the carcasses and organs of such animals are submitted for human food, the decision as to their fitness for this purpose should devolve upon the Medical Officer of Health or Veterinary Inspector authorized or appointed by the Local Authority In any case where it is found that the disease is strictly localized, that no signs of septic infection are present, and that there is entire absence of any indication of fevered condition such as wasting, hyperæmia of the internal organs or of the lymphatic glands and of other complications which may arise as sequelæ of the disease, it will be for the consideration of the officers mentioned whether the carcass may be passed for human consumption after removal of the head and feet

In a subsequent circular on foot-and-mouth disease dated 2nd May, 1922, (Circular No. 306) the Ministry of Health state·

As regards the question of the disposal of meat, attention is drawn to the Memorandum on Meat Inspection (Memo 62/Foods) enclosed with Circular 282 of the 16th March, 1922, in which directions are given as to the disposal of such carcasses for human food.

In this connexion it should be observed that the carcasses of suspected animals may be derived from two sources

(1) from the farm where affected animals and their contacts have been slaughtered by order of the Ministry of Agriculture and Fisheries, and

(2) from slaughter-houses where animals have developed the disease whilst being kept for slaughter

In the first case the carcasses of all affected animals are destroyed by order of the Ministry of Agriculture and Fisheries, and carcasses of those animals only which have shown no signs of the disease are allowed to be taken from the infected premises after removal of such parts as the head, feet and hide, which are likely to harbour infection

In the second case no responsibility as to the disposal of the carcass is undertaken by the Ministry of Agriculture and Fisheries, and it is therefore necessary for the Medical Officer of Health to exercise vigilance as to the disposal of such carcasses (See footnote 3 above) As already stated, the Medical Officer of Health will be notified of the occurrence of foot-and-mouth disease in slaughter-houses, and will thus be afforded opportunity for making the necessary inspection whilst the various organs and parts are available for examination

The right of the Medical Officer of Health to enter premises where an animal is affected with the disease is, under the proviso to section 9 (4) of the Contagious Diseases (Animals) Act, 1886, limited by the necessity of obtaining the permission of the Local Authority under the Diseases of Animals Acts It is hoped that the permission will always be given, but it will of course be necessary for the Medical Officer of Health to comply with the prescribed requirements as to the disinfection of hands and clothing, &c.

MEAT INSPECTION IN SCOTLAND

Provisions relating to the inspection of meat in Scotland are contained in Sec. 43 of the Public Health (Scotland) Act, 1897, and the Public Health (Meat) Regulations (Scotland), 1932, which appear in full on page 425.

The regulations are detailed and comprehensive. They combine the Meat Regulations issued in 1924 with instruction as to meat inspection, and, being statutory, they must be complied with.

In addition to instruction with reference to inspection, requirements are set out regarding the qualifications necessary for inspectors of meat. The latter are of two classes, namely: (*a*) meat inspectors, and (*b*) detention officers (persons empowered to detain abnormal carcasses, organs and viscera until inspected by a meat inspector).

(*a*) Meat inspectors: " No person shall be qualified to act as Meat Inspector under these Regulations unless he is either the Medical Officer of Health of the area, or a veterinary surgeon, or a person who, not being the Medical Officer of Health, or a veterinary surgeon, has received special training in the work of meat inspection and, prior to the first day of June, 1932, has had not less than seven years' practical experience in that work and has obtained from the Department [1] a certificate (which may at any time be cancelled or withdrawn) that he is qualified to act as a Meat Inspector in the execution of these Regulations."

(*b*) Detention officer: " No person shall be qualified to act as a Detention Officer under these Regulations unless he has had such experience and training as the Meat Inspector of the area may consider necessary to enable him to recognize any departure from the normal in the carcass, organs, or viscera of an animal."

Records are required to be kept at all abattoirs of all animals slaughtered, of carcasses seized, and of details of the carcasses inspected.

Specification of days and hours of slaughter in private slaughter-houses is necessary, and notice of slaughter in emergency for accident, illness, &c., is compulsory.

Bye-laws for slaughter-houses and for the business of slaughterer must be made by Town and County Councils.

Authorization is given for the use of identification marks by Local Authorities and their inspector for the marking of carcasses which have been inspected and passed by the inspector as free from disease.

It is forbidden to keep or store meat or meat food products intended for sale for human consumption in a stable, byre, or in premises in which animals live or are kept, or in any room used as a living room or sleeping room, or in any premises which are not kept clean or in a sanitary condition.

[1] The Department of Health for Scotland.

Permission is given to Local Authorities to require certification of approval of storage accommodation for meat and meat food products from persons other than shopkeepers. Every Local Authority is required to keep a register of all cold stores within their area.

Power of entry for the purpose of inspection is given to officers appointed by the Department both to public and to private slaughter-houses.

The schedule for the inspection of carcasses, organs and viscera differs in some particulars from that of the Memorandum 62, Foods, of the Ministry of Health. The main variations are set out below.

Part I.—Under the General Instructions provision is made for the detention by the detention officer of any carcass, organ, or viscus in which disease, or appreciable departure from the normal, is found, or of any carcass which is emaciated or poorly nourished. The detention officer must notify the meat inspector of such detention.

Part III.—The glands which must be examined when tuberculosis is found are detailed for each area.

Part IV.—The procedure for seizure of the head when evidence of tuberculosis is found in the retropharyngeal, parotid, and submaxillary glands, is that where two of the glands are affected, the head shall be seized. When the retropharyngeal alone is affected in bovines or the submaxillary in swine, unless the lesions are small, inactive, and calcareous and the gland is not enlarged, the head shall be seized.

In dealing with localized lesions " in cases of widespread infection that do not fall within the category of generalized tuberculosis, the rump or rumps shall be seized only when lesions exist in the popliteal gland, and the shoulder blade or shoulder blades when lesions exist in the prescapular or brachial glands ".

Part V.—Relating to the diseases in which condemnation of the entire carcass and all the organs and viscera is required:

Foot-and-mouth disease is not included.

Odour associated with disease or otherwise prejudicial to health is included.

The following conditions are somewhat qualified in the Scottish Regulations:

Decomposition is not limited to " generalized decomposition ".

Fever is not qualified by the word " acute ".

Mammitis includes " gangrenous " in addition to " acute, septic ".

Pneumonia includes " septic " as well as " gangrenous ".

Cysticercus bovis (beef measles), in the event of evidence being found in a carcass and/or in a head, the carcass and/or head may be passed for human consumption provided that they are placed in cold storage at a temperature not higher than 20° F. for a period of at least three weeks, or, alternatively, they shall be destroyed.

CLASSIFICATION OF DOMESTIC ANIMALS ACCORDING TO AGE AND SEX

Before proceeding to consider in full the routine inspection of animals, it will be well to set out the classification of the domestic animals according to their age and sex.

Cattle.

MALES. Bull: uncastrated male more than one year old.
Segg: a male castrated after having been used for service.
Bullock, Ox, Steer, Stott: castrated males over one year that have never been used for service.
Bull-calf: a male up to one year old.

FEMALES. Cow: a female that has had a calf.
Heifer, Stirk, Quey: females over one year that have never calved.
Heifer-calf: a female up to one year old.

Sheep.

MALES. Ram, Tup: uncastrated male after the second shearing.
Wether: castrated male after the second shearing.
Shearling Tup, Shearling Wether: uncastrated and castrated males respectively between the first and second shearing.
Tup Hog, Wether Hog: uncastrated and castrated males respectively between weaning and first shearing (under one year).
Tup Lamb: any male from birth to weaning at two or three months.

FEMALES. Ewe: female after it has had a lamb (generally over one and a half years).
Threave, Gimmer: female between first and second shearing (over one year old).
Ewe Hog: female between weaning and first shearing (under one year old).
Ewe Lamb: female after birth until weaned (two to three months old).

Pigs.

MALES. Boar, Brawn, Stagg: uncastrated male.

Hog, Shott: castrated male that has never been used for service.

Brawner: a male castrated after having been used for service.

FEMALES. Sow: female of any age that has farrowed (borne young).

Gilt, Gelt: an uncastrated or unspeyed female that has never farrowed.

Cut Sow, Speyed Pig: a castrated female.

Squeakers, Porkers, Suckers: newly born pigs of either sex.

CHAPTER II

Inspection of Live Animals

Routine Inspection of Live Animals—Characteristics of Healthy and Sick Animals.

When called upon to inspect a living animal, the inspector should make a general survey of the beast, in order to see if anything abnormal in its appearance or manner of action presents itself. The following points should be noted: the kind of animal—ox, calf, pig, sheep, &c.; whether male or female, and, if male, whether castrated. The age of the animal is also a matter of importance, and may be ascertained by an examination of the teeth. The age of a cow may also be determined approximately, by counting the rings on the horns (which indicate the number of calves she has had) and adding two to their number.

CHARACTERISTICS OF HEALTHY AND SICK ANIMALS

General Appearance.—A healthy animal is alert, has a clear bright eye, and takes notice of everything that goes on around. If approached, it endeavours to escape, and, if lying down, it rises without effort and walks or runs away.

A sick animal usually looks tired, and stands with head depressed. Its eye is moist and expressionless, it does not move when approached, and, even when struck, may move out of the way and no more. It may be lame, or rise with effort when suffering from injury, rheumatism, or certain illnesses such as " black leg ". Unsteadiness, or even paralysis of gait, may be present. Shivering may occur in certain infectious and inflammatory diseases.

Sick animals often lie down and are loth to rise; the fat pig, however, even when quite healthy, generally exhibits a state of perfect apathy, and may lie snoozing, regardless of what is taking place in the immediate vicinity.

Coat.—In health the coat should be loose, soft, "mellow", and freely movable on the underlying structures: the hair glossy and smooth lying close to the skin, with no tendency to stand on end, and no bare patches. In sickness the coat presents a rough and "staring" appearance, and may be hidebound. The hair may stand on end (though even healthy animals in cold sheds may present this appearance), and be matted together by blood, pus, saliva, or nasal secretions. Hairless patches on the skin may be due to ringworm, and nodules or swellings to warbles. Signs of vermin may be present, or there may be sores or ulcers around the jaw and neck, as in actinomycosis. A diffuse red colour of the skin of swine may point to swine erysipelas or "red soldier".

Temperature.—If the hand be run over a healthy animal it will be found that the trunk feels warmer to the touch than the ears, points of the horns, and hoofs, which are comparatively cold. Whereas in fevered animals the ears, points of the horns, and hoofs feel warm. If it be desired to take the temperature more accurately, a thermometer must be inserted into the bowel and tied to the tail. In cattle the normal temperature is about 101·5° F., in the horse it is 101° F., in sheep 104° F., and in pigs 102° F.

Pulse.—The pulse of cattle may be felt on the outside edge of the lower jaw, or on the tail; normally it should be about 40 per minute. Horses have a normal pulse rate of about 35 per minute, while that of sheep and pigs averages about 75 per minute. In the horse the pulse is felt on the inside edge of the lower jaw, and in sheep and pigs on the inside of the thigh over the femoral artery. In disease the pulse may be rapid, running, or irregular according to the condition present.

Respiratory Organs.—The muzzle of a healthy animal is cool; there should be no discharge from the nostrils save, perhaps, a little clear mucus without any smell. If this discharge becomes yellow and purulent, perhaps mixed with blood, it points to disease of the respiratory organs.

Healthy animals take regular easy breaths, and carry on the process of respiration without apparent effort, and without much noise. Animals suffering from disease of the lungs or respiratory passages breathe rapidly, and their respirations are accompanied by violent movements of the thorax and abdominal walls, and dilatation of the nostrils. Animals that have been hurriedly driven will "blow" and breathe rapidly for some time after coming to a standstill.

Coughing frequently accompanies disease of the respiratory passages, lungs, or pleuræ; in laryngeal conditions respiration becomes noisy, and the animal frequently stretches its head out in order to obtain relief.

Pigs grunt normally, and if they cease to do so, something amiss may be suspected; whereas, in cattle, grunting is a sign of some abnormal condition and is a frequent symptom both in pneumonia and in disease of the third stomach.

Digestive Tract.—In live animals some idea of this important system may be gained by noting the condition of the lips, the muzzle, and, if possible, the manner in which the animal eats and drinks. The lips of a sound animal are closed and saliva does not make its escape.

In unhealthy animals foam may collect at the mouth and saliva trickle in long stringy shreds. The muzzle of a normal animal is moist and cool; in disease, and especially in feverish disturbances, it may become dry, warm, and rough, whilst raised sores may point to foot-and-mouth disease.

Healthy animals eat and drink greedily; in illness they frequently eat but little and may entirely refuse to drink. In health the chewing of the cud follows regularly after the partaking of food; in disease it is frequently delayed, or ceases.

In healthy animals the bowels move from time to time, the dung being of normal consistence, not mixed with blood, and without much offensive odour.

In inflammation of the bowel the tail and hind-quarters may be soiled with dung which is thin, watery, and offensive; mucus or blood may also be present. If blood be present without diarrhœa, anthrax should be suspected.

Enlargement or swelling of the abdomen, especially on the left side, may be due to " hoven " or " blown " or some other abnormal condition of the stomach.

Urino-Generative Organs.—Healthy urine is of a clear yellow colour, and is passed in a single strong stream. Muddy, thick urine mixed with mucus, and possessing a disagreeable smell, generally points to disease of the urinary bladder, especially if micturition be frequent and the stream thin and broken up.

Red urine is passed in red water fever and anthrax.

In healthy animals the vagina is closed, there is no swelling about the part, and no discharge, save, perhaps, a slight clear viscid-

looking secretion. The mucous membrane is normally of a whitish red colour without sores or wounds.

In disease swelling of the external genitals is frequent, and there may be a whitish discharge in vaginal catarrh.

Retention of the after-birth is accompanied by a foul-smelling discharge, while part of the decomposing structure frequently hangs from the vagina. Animals in this condition should on no account be slaughtered for food, as the use of their flesh has been known to give rise to food poisoning.

Udder.—In young animals that have not yet calved the udder is comparatively small, and firm and tense to the touch. In newly calved cows it becomes much distended and of a uniform soft consistence. Some cows have a swelling in front of the udder; this is natural and of no significance.

In inflammatory conditions the udder becomes distended, feels hot to the touch, is painful when handled, while from the teats a watery fluid containing cheesy matter or clots may be expressed.

(For the conditions found in tuberculosis of the udder, see p. 100.)

Dropsy or Œdema gives rise to a swelling which may be general, occurring all over, or local, confined to one particular part. It is due to collection of serous fluid in the cellular tissues, and points to some derangement of the circulatory system. If the finger be pressed into the affected part, a depression is left when it is removed, and it is said to " pit on pressure ".

Injuries, &c.—Animals not infrequently receive injuries during transit in boats, railway trucks, &c. Thus wounds of one kind or another may be found. These should always be carefully examined to see if they penetrate deeply into the underlying structures, and whether pus (" matter ") exudes from them, when they are said to be " septic "; animals with large septic wounds should not be used for food.

Fracture of bones may occur; fracture of the pelvis may be produced by the sudden slipping apart of the hind-legs on wet pavements. Animals suffering from fractured limbs are generally found lying down, and make no attempt to rise even when goaded.

Animals that have been transported long distances by rail may stagger about as though they were suffering from anthrax in its early stages; their pulse becomes accelerated, but their temperature does not rise; death sometimes results.

CHAPTER III

Inspection of the Carcass and Organs

Dressing of the Carcass—Proper Manner of Conducting Work in the Slaughter-house—Routine Inspection of the Organs and Carcass—Special Points in connexion with the Inspection of Calves, Sheep, and Pigs—Inspection of Dressed Carcasses—Means of Estimating the Age of Slaughtered Animals—Points of Distinction between the Carcass of the Ox and the Horse—Test for Horse-flesh—Meat Marking.

It is desirable, whenever possible, that the inspector should be present at the slaughter and dressing of every animal that it is his duty to examine. In large abattoirs, however, where slaughtering is carried on in many different booths at the same time, it is quite impossible for the inspector to superintend the killing and dressing of every animal. In slaughter-houses where booths have been abolished, and large halls built in their place, a more efficient supervision of all that goes on is practicable.

Among the improper procedures that are occasionally adopted with the view of removing evidences of disease, the following may be mentioned:

Abscesses or parasites may be cut out, tuberculous deposits may be removed along with their corresponding lymphatic glands, and, perhaps most common of all, the pleura or peritoneum may, on account of tuberculous or inflammatory conditions, be stripped from the thoracic and abdominal walls, and in order to conceal the true state of matters, fat may be rubbed, or a cloth dipped in warm or bloody water may be smeared, over the part.

When parts of organs have been cut away, the fact is readily recognized by the loss of substance thus caused; but the stripping of the pleura is not always easy to detect. If in such cases a careful examination be made, it will be seen that the ribs and intercostal muscles are exposed, being covered only by an opaque subpleural connective tissue instead of by the smooth and glistening pleura.

If the edges of the diaphragm be examined the bared muscle fibres will be revealed.

In cases of difficulty a sponge wrung out of hot water should be applied to the inner surface of the chest, when the absence of the pleura is more readily detected. The flame of a lighted match is reflected from the pleura when intact, but if it has been stripped the exposed tissues do not reflect the flame.

If the pleura has been stripped, an exaimnation of the thoracic glands may reveal a tuberculous condition; if they also have been removed, the whole carcass should be condemned.

DRESSING OF THE CARCASS

As soon as bleeding is completed the dressing of the carcass is begun, the process varying slightly according to the animal. In some the hide or skin is not removed, e.g. calves and pigs; others are skinned, namely, cattle, sheep, and horses. Some carcasses have the head removed; others, such as the pig, have the head left attached to the carcass.

Dressing of Cattle.—The animal is turned on to its back, when a general survey of the beast may be made, including the condition of the feet, and if a cow, the udder. While on its back the feet are removed, the head skinned, taken off, and as much of the skin as can conveniently be reached is stripped, and for this purpose a long incision is made from the neck to the anus, the skin being taken off backwards on either side.

The abdomen is then cut open, beginning at the sternum and ending at the pubis, the breast bone is sawn through and the caul fat, or omentum, removed. The carcass is now hoisted and the intestines, mesentery and stomachs removed. The spleen in cattle is attached to the paunch and is taken out along with that organ. The pelvic organs are next excised, including rectum, bladder, and (in females) the uterus.

The liver is now removed and the diaphragm cut, exposing the lungs, trachea, œsophagus, and heart, which are taken out and hung up without being separated. The pillars of the diaphragm or " thick skirt " is taken out and hung up separately. In cows the udder is cut off as the carcass is being hoisted. The carcass is then thoroughly wiped down and the vertebræ split from the sacrum to the neck, leaving the carcass hanging as two sides of beef.

The internal organs of sheep, calves, and pigs are taken out almost in the same manner as cattle organs, except that the livers are left attached to the lungs, heart, and trachea—the whole being called the " pluck ". In the case of calves and pigs the œsophagus will be found attached to the pluck, but in sheep it is left attached to the rumen. In calves and sheep it may be left attached to the diaphragm or removed with the pluck.

Calf Carcasses.—The skin is often left on the carcass when suspended as it helps to keep the flesh a better colour, and to prevent the loss of moisture. The carcass may be subjected to " inflation " with a view to render the flesh more plump in appearance (horse-flesh is also sometimes inflated). A canula is introduced by making a slit in the skin, as a rule near the hock. A pump or bellows is attached to the canula and air is pumped throughout the body, the carcass being struck with a broom handle or the hand in order to break the tissues and allow the air to penetrate them. The pump must be kept scrupulously clean, otherwise the process is objectionable. Mouth inflation is prohibited by the Public Health (Meat) Regulations, 1924, and in some districts it had been previously forbidden by local Acts.

It is claimed that inflation, by driving the fluids into the tissues, enhances the keeping quality of the flesh. When handled inflated meat feels spongy and may crackle from contained air.

Pig Carcasses.—As soon as the throat of the pig has been cut, the animal is hung up by the hind-legs until bleeding is completed. (Sometimes the animal is suspended before the throat is cut.) The skin of the pig is not removed in dressing, but the hair is got rid of by plunging the carcass into a trough of scalding water, and thereafter scraping the skin with small hoe-like instruments, the process being completed by the use of sharp knives. It is usual for not more than a few minutes to elapse between the time of stunning and scalding of the pig. When free of hairs, the carcass is once more suspended, and is then eviscerated and the dressing completed. As noted, the head is left on the carcass, the tongue may be freed from the sides of the jaws, and is then removed along with the heart, lungs, and liver, as the " sling " or " pluck ".

PROPER MANNER OF CONDUCTING WORK IN SLAUGHTER-HOUSES

The following system of inspection is recommended by Dr. Leighton of the Scottish Department of Health[1]:

" In every slaughter-house the killing arrangements should be such that the organs from any given carcass should be hung up in such a way that they can be readily identified by the inspector with the carcass from which they came. This could be readily done by a system of numbering the hooks upon which the organs and the carcass are hung.

" **Public Abattoirs.**—The animals having arrived at the slaughter-house, and having been inspected when alive for any signs of infectious or other disease, should always be killed in the presence of an inspector. After being bled, and when the preliminary part of the skinning process has been carried out and the feet removed, the carcass should be hauled

[1] Report on an Inquiry into a Uniform System of Meat Inspection in Scotland.

off the ground by one of the various mechanical contrivances devised for this purpose, and the further dressing of the carcass carried out. It is far too common to skin the carcass entirely while it is still on the floor, and even to disembowel it in that position. The floor of most of our slaughter-houses is, as a rule, far from clean, whereas, of course, it should be scrupulously clean. The organs, instead of being flung into a corner and allowed to accumulate in a heap, as is too often the case, should be hung, as I have said, on numbered hooks, enabling them to be identified. The carcass should be hung at such a height that a small hand-cart, or tray on wheels, can be pushed under it before the contents of the abdomen are taken out. When opened, these contents should be received on the tray mentioned. The inspector, being present, can then make at once a rapid and systematic inspection of the stomach, intestines, spleen, &c., and note at once the presence or absence of disease. The hand-cart then being removed to a little distance to allow of the further dressing of the carcass, the inspector can then make a more detailed examination of the organs. While he is doing this the contents of the thorax will have been removed, and should be hung on an adjacent numbered hook. The inspector then turns to these and examines the heart, lungs, and liver, as well as the head, Having thus systematically examined all the important organs, which has taken a very few moments, the inspector has formed an opinion as to the general health of the carcass he is dealing with, and he has then only to turn his attention to the carcass itself for examination of its condition, presence or absence of bruises, the kidneys, signs of inflammation, and so forth. The degree of detail with which the carcass itself is examined will usually be determined by the condition of the organs which at first came under his notice. If this simple method of systematic examination were carried out, very little that should be observed would escape the eye of an inspector."

The inspection of diseased organs should not be conducted with the ordinary knives and instruments employed for butchering, because contaminated instruments and hands may convey the contagion to otherwise healthy flesh. Further, knives used to dress a diseased carcass should be sterilized before being employed again, and the inspector should see that this is carried out. (Memo. 62, Foods, C. II.)

In country slaughter-houses it is no unusual sight to see a butcher use the same cloth with which he has just wiped down a tuberculous carcass, to cleanse the carcass of a perfectly healthy animal, thus contaminating its flesh with tuberculous material. In order to prevent such occurrences it is the custom in certain public abattoirs to provide special cloths, which are supplied gratuitously to the butchers when they have a diseased carcass to clean, and which are kept exclusively for that purpose. After use such cloths are dropped into a liquid disinfectant, from which they are removed and boiled before being employed again.

ROUTINE INSPECTION

The inspection should be conducted as follows:[1]

The Head.—Examine the exterior (abscesses, actinomycosis, "lumpy jaw"), nostrils, lips, gums, and mouth (foot-and-mouth disease).

Incise the submaxillary, retropharyngeal, and parotid glands (tuberculosis, actinomycosis). The external and internal masticatory muscles may be incised (cysticerci).

The Tongue should be inspected and palpated (actinomycosis, "wooden tongue", foot-and-mouth disease).

The best mode of palpation is to seize the tongue with the left hand near its root, then grasp the organ firmly with the right, and while continuing to grasp it firmly, run the hand over it from the root to the tip. By this means any irregularities or nodules in the interior are easily detected. Should such be discovered, the tongue should be laid open by an incision in the median line, when the cause can be ascertained.

The Lungs should be palpated all over, and a transverse cut made in their lower half through the ramifications of the trachea (tuberculosis, inflammatory conditions, echinococci, and other parasites).

The bronchial glands should be incised; they are reached by incising the pulmonary tissues, downwards and outwards from the apex of the lung to the point of bifurcation of the trachea. The mediastinal glands, which lie between the lungs on the dorsal surface, are exposed by cutting through the mediastinal serous membrane; they should be incised and examined for tuberculosis. When tuberculous mediastinal glands are found tuberculosis is likely to be present in some form in the abdominal cavity, peritoneum, or liver.

Aspirations of Blood, or Stomach Contents.—During slaughter, especially by the Jewish method, owing to the violent inspiratory efforts of the animal, blood, or the contents of the stomach, may be drawn into the trachea or bronchi. The conditions are readily recognized by making a cross-section in the lungs below the bifurcation of the trachea. In the former, areas of red intervening with parts of normal colour will be found here and there throughout

[1] See also the instructions in Memo 62, Foods, p. 165, and Table of Diseases found in Cattle Sheep, and Pigs, p. 153.

the pulmonary tissue, while the bronchi may be filled with blood in a coagulated or non-coagulated condition. In the latter, the bronchi are full of semi-digested fodder. When the lungs contain aspirations of stomach contents in large quantities or excessive aspirations of blood they should be condemned.

The Liver should be palpated and inspected, and one or two incisions made into its interior. Change in colour, appearance, or consistence should be carefully noted (tuberculosis, fatty degenerations, tumours, parasites, bacillary necrosis, abscesses, &c.).

If the bile ducts be enlarged and thickened and visible on the outside of the liver, the presence of liver flukes may be suspected, and incisions should be made into the substance of the organ, when, if flukes be present, they will be seen making their way through the bile ducts and falling out of the cut ends. It is not unusual to find large abscesses containing greenish yellow pus in livers affected with flukes.

The portal lymphatic glands should not be removed before the liver is inspected, as they frequently afford evidence of disease when none can be found in the substance of the organ, and are in consequence sometimes removed by unscrupulous tradesmen. These glands should always be incised and examined for evidence of tuberculosis.

The Heart.—The pericardium, or "bag", should be opened, and a longitudinal incision made into the organ itself from apex to base in such a manner as to open into the left and right ventricles. Any changes of colour or abnormal appearance of the heart walls, or myocardium, should be noted (hæmorrhages, degenerative changes, cysticerci, echinococci, &c.). An inflamed condition of the internal lining, or endocardium, or valves of the heart (endocarditis) should be looked for.

The Mesentery should be examined and the lymphatic glands incised (tuberculosis).

The Stomach should be inspected externally, and cut open so that a view of the mucous membrane within may be obtained (serous tuberculosis, inflammations, actinomycosis, tumours, parasites, &c.). The gastric lymphatic glands should be incised (tuberculosis).

The Spleen should be carefully palpated, and, if nodules or thicknesses in its substance be detected, longitudinal incisions may be made in order to discover their nature. Enlargement of the organ is seen in anthrax, and erysipelas, and blood diseases. (Tuberculosis

is more common on the surface in bovines and in the substance in swine.)

The Intestines may be cut open, but not in such a manner as to destroy their value for sausage skins, unless disease be suspected (tuberculosis, intestinal anthrax, hæmorrhages, inflammation, parasites).

The Uterus should be examined externally, and any enlargement, evidences of inflammation of the surrounding parts, or tuberculosis of its peritoneal covering, observed. An incision should then be made through the centre of the body of the uterus, and, if tuberculosis or any other disease be found in the interior, the body and horns should be freely opened up, so that its extent may be discovered. If the placenta, or after-birth, be retained, or a purulent condition of the interior of the organ discovered, condemnation of the whole animal must be considered.

The Udder should always be carefully palpated and incised (tuberculosis). Tuberculous abscesses are rarely met with in the udder; abscesses in this organ should therefore, as a rule, be looked upon as non-tuberculous. Actinomycosis is sometimes found in the udder of swine.

Carcass.—A general survey should be made of the carcass as it hangs skinned and dressed. The sex of the animal should be observed. (See p. 193.)

Young cows should always be carefully inspected, because they are more profitable when retained for milking purposes than when sold to the butcher. Cameron has noticed that cows slaughtered on account of sterility are frequently tuberculous. The inspector should look with suspicion on a cow sent to the slaughter-house shortly after calving, and he ought to make certain that the animal was not affected with puerperal septicæmia.

Condition of the Meat.—It is difficult to judge of the condition of the flesh in newly slaughtered animals, when it is normally brownish red and flabby in consistence. It is easier to do so some twelve hours later, when the carcass has " set ". Rigor mortis, or " setting ", generally supervenes about twelve hours after slaughter, and produces a stiffening of the carcass—this process is well marked in healthy animals. The muscular tissue of a healthy ox should be of a light red colour, the colour being brighter in young than old animals. It should be firm and elastic to the touch and more or less dry after being exposed to the atmosphere. It ought to possess a pleasant odour, be mottled or marbled with fat (this appearance is

well seen in the roasts), the graining of the muscles on transverse section should be fine. The connective tissue should glisten on exposure and be moist, but fluid should not escape from it.

The condition of the animal in fat should be noted—emaciation generally points to some diseased condition. It should further be observed whether the animal has been properly bled. A carelessly dressed carcass should at once excite suspicion, because the butcher is unlikely to waste much time on the dressing of a carcass that he expects to be condemned.

A minute examination of the external surface of the carcass should be made (hæmorrhage, tumours, parasites, collections of air (emphysema) or fluid (œdema) in the tissues). Hæmorrhagic patches should be incised to ascertain whether they are superficial or whether they extend deeply into the substance of the meat, as is found in cases of fractured bones, &c.

On the internal surface of the carcass the pleura and peritoneum should be carefully inspected (tuberculosis, inflammations). The diaphragm frequently hangs down and conceals part of those serous membranes; it should therefore always be lifted, and the parts beneath inspected.

The Superficial Lymphatic Glands, prepectoral, suprasternal, renal, supramammary or superficial inguinal, &c., should be incised (tuberculosis).

Bones.—The vertebral column, os pubis and sternum should receive attention (tuberculosis, fractures, osteomyelitis).

Joints should be examined (tuberculosis, rheumatism, &c.).

It is very desirable that the inspector should not cut into the carcass more than is necessary. Some inspectors cannot make up their minds whether the animal was healthy or diseased without cutting up the carcass in an unjustifiable manner. The internal organs furnish the chief evidence of disease. If these are inspected in the manner described above, without diseased conditions being found, the inspector should by a careful examination of the carcass, and by incising the superficially placed lymphatic glands, be able to come to a conclusion as to the fitness of the flesh for human food. If, however, evidence of disease, such as tuberculosis, be discovered in the organs, then the inspection of the carcass must be more thorough, and a larger number of lymphatic glands must be incised, in order to determine what parts are to be destroyed and what released, in cases in which total seizure is unnecessary. (See Memo. 62, Foods.)

Inspection of Calves.—Attention should be paid to the following points. The navel should in each case be inspected carefully to see if any suppurative condition exists either in it or the surrounding parts (navel ill, umbilical pyæmia). Any swelling of the joints should arouse suspicion, and, if present, they should be opened. In suppurative conditions a yellowish fluid may be found in their interior (calf lameness). Inflammatory conditions of the small intestine may be present in calves which have suffered from diarrhœa.

Lesions of tuberculosis are frequently found in the liver and spleen, and may be present in the mesenteric glands. Ostertag has pointed out that perforative ulcer of the stomach is not uncommon in calves. Search for cysticerci is unnecessary as calves under six weeks old never harbour these parasites. Veal is pale red in colour, and not firm in consistence. The fat is tallow-like in appearance.

Slink Veal.—The flesh of newly born, or unborn calves, has a pale bluish red watery appearance. The lungs of an unborn calf are collapsed. The flesh of very young animals is injurious to health.

Inspection of Sheep.—Sheep call for little remark. Their organs are inspected in a similar manner to those of cattle; parasites are frequently found in their lungs, and flukes in the livers. The flesh of sheep has a light red colour, fine fibre, and moderately firm consistence. The fat is firm and very white in colour. The muscular tissue is not marbled with fat as in the ox.

Inspection of Swine.—In the process of dressing, swine are, as a rule, split in half vertically through the spinal column and head; this facilitates their inspection, which is conducted in the same manner as in cattle. On account of the prevalence of tuberculosis in pigs, the following glands should always be examined in the routine inspection of the animal: submaxillary, cervical, suprasternal, superficial inguinal, deep inguinal, and iliac glands.

It should be remembered that actinomycosis may occur in the udder of pigs. Cysticerci are not infrequently found in the tongue, heart, diaphragm, intercostal, and masticatory muscles. The mucous membrane of the large intestines and cæcum ought to be examined for the presence of swine-fever ulcers.

Search for trichinæ is seldom prosecuted in this country. If the presence of this parasite be suspected, or if it be thought desirable to look for it, small specimens should be taken for microscopic examination from the pillars and costal portions of the diaphragm, the muscles of the tongue, and the laryngeal muscles, as, if the animal

is infested with this parasite even in the slightest degree, these muscles will contain it.

Pork is pale red or rose coloured, some parts may be white. It is infiltrated with fat and rather soft in consistence. The fat is white and soft and forms a layer round the kidneys and under the skin of the back and sides. Old boars have a characteristic and unpleasant smell.

Inspection of Dressed Carcasses.—The inspection of dressed carcasses is always a matter of difficulty. The internal organs bear the chief evidence of disease, and in their absence no adequate inspection is possible.

The pleura and peritoneum should be carefully examined for the presence of tuberculosis. The superficial lymphatic glands of the trunk should likewise receive attention. If the pleura be stripped, or the lymphatic glands removed, the carcass should be condemned.

If the head be available, the masticatory muscles may be incised and examined for the presence of cysticerci, as, if the carcass harbour any such parasites, they will be found in these muscles. In the case of the pig the heart and tongue should be examined for a like reason. In female animals the glands receiving lymph from the udder and uterus should always be incised and inspected for evidences of inflammation. If such be found, the carcass should be condemned, as septic conditions in these organs render the meat highly unfit for food.

The Age of the Animal may be ascertained by an examination of the teeth. Where the head is not available, a rough idea may be obtained by the degree of ossification of the various bones of the body.

Young Animals.—In young animals the bones are soft, smaller, and more vascular than in older animals. The inner surface of the ribs is pink. There is much gristle or cartilage at the joints. This is well seen at the ischio-pubic symphysis, which can be cut through with a knife in animals of three years old or under. The flesh of young animals should be bright red, firm, and juicy, but not too moist, and well marbled with layers of fat, especially in the loins.

Old Animals.—In old animals the bones are hard, dense, large, and non-vascular. The inner surface of the ribs is white and shiny, and " bleached " in appearance. The gristle is less well marked at the joints, and is absent at the ischio-pubic symphysis. The flesh is stringy, tough, and less marbled with fat.

Horse-flesh.—It is important that the meat inspector should be able to distinguish the carcass of a horse from that of an ox, as the flesh for the former animal is not permitted to be sold in this country unless in shops specially set aside for that purpose.

Test for Horse-flesh.—The flesh of the horse contains more glycogen than that of other animals, and the presence of this substance has been used as a means of identifying it. A simple test for glycogen in flesh, introduced by Brautigam and Edelman, simplified by Courtoy and Coremans, may be carried out as follows: 50 gm. of minced flesh are boiled in 200 c.c. of water for from fifteen to thirty minutes. After cooling the broth is filtered. To a portion of the filtrate in a test tube a few drops of the following solution are slowly added: iodine 2 parts, potassium iodide 4 parts, water 100 parts. The test tube should be held up to the light while this solution is being added, and should glycogen be present, a faint tinge of violet will be seen in the broth on the addition of the first few drops.

If a brownish violet colour be distinctly visible, the flesh under examination is horse-flesh. This colour should disappear when the broth is heated to 80° C. and reappear on cooling. Should the broth take on a deep violet tint, starch is present (this may be got when testing sausages, which frequently contain bread crumbs or other cereals) In such a case it is advised that twice its volume of acetic acid should be added to the broth before testing.

MARKING OF MEAT

Marking of meat falls under two headings: (*a*) meat marked after inspection to indicate that the carcass or part of the carcass was free from disease, sound, and wholesome for the food of man at the time of inspection, and (*b*) meat marked for grading of quality.

(*a*) **Meat Marking after Inspection.**—Under the Public Health (Meat) Regulations, 1924, the Minister of Health is empowered to authorize a Local Authority to use a distinctive mark for carcasses which have been inspected at the time of slaughter, and found to be free from disease. But the L.A.[1] must satisfy the Minister that suitable arrangements have been made for the inspection of animals at the time of slaughter, and that competent inspectors have been appointed, or employed. No part of a carcass may have the mark applied unless the inspector has inspected the whole carcass with the organs in position, and such part has appeared to him to be free from disease, sound, wholesome, and fit for the food of man. Consent of the person having possession of the carcass at the time of inspection must be obtained before the mark is affixed or impressed. The L.A. is empowered to charge for marking, but not in excess of 1*s.* per carcass or part of a carcass. No L.A. shall use or permit to be used a mark indicating that inspection has been made unless they have

[1] Local Authority.

been authorized by the Minister of Health and their mark approved.

Circular 547, issued by the Ministry of Health, states " it is considered that the marks should be impressed in ink or branded on the carcass itself, and that every mark should comprise (1) the word 'Inspected', and (2) the name of the Borough or District, and (3) in areas where one or more Inspector is employed, a cypher (such as initials) to identify the individual Inspector, these particulars being shewn in block lettering within a surrounding line ".

Similar powers are given to Local Authorities in Scotland under the Public Health (Meat) Regulations (Scotland), 1932.

Little advantage has so far been taken of the powers conferred.

(*b*) **Meat Marking for Grading of Quality.**—Under the Agricultural Produce (Grading and Marking) Act, 1928, powers are given to the Minister of Agriculture and Fisheries in England, and the Department of Agriculture for Scotland, to make regulations " prescribing grade designations for any kind of agricultural produce, and defining the quality indicated by such designations ". Only persons authorized to do so may mark any article with a statutory grade designation mark. Schemes are in force in London and a few Boroughs and graders with suitable experience and training have been appointed, who alone are authorized to grade and mark the meat. A Marketing Leaflet No. 13, issued by the Ministry of Agriculture and Fisheries, sets out the grades and method of marking. The Appendix to the leaflet is printed in full on pp. 191-192 as it defines in detail the grade definitions.

In England three grades have been adopted, and given statutory effect in the Agricultural Produce (Grading and Marking) (Beef) Regulations, 1929. The best meat is termed " Select ", and is obtained from young animals of exceptional quality, the next quality is called " Prime ", and is beef of excellent quality, but from older animals than " Select " beef. The third grade is that of " Good " beef, which is mainly obtained from bullocks and heifers, but also from young cows.

Marking is done by means of a roller stamp which is drawn down the whole side of the carcass, marking it with the words " Select ", " Prime ", or " Good ", as the case may be. The colouring matter utilized for stamping is certified as non-injurious by the Government chemist. The stamp, besides naming the grade of meat, bears the words " Home killed " and has a map of England and Wales below these words. In Scotland the mark bears a map of that country, and two grades of meat only are recognized, namely, " Select " and " Prime ".

A further scheme [1] is under experiment whereby farmers may send their fat cattle direct from the farm to the abattoir for sale by dead-weight on the basis of National Mark beef grades.

Both schemes are as yet in their infancy, but appear to be gaining

[1] National Mark Beef Scheme, Marketing Leaflet No. 27, Ministry of Agriculture and Fisheries.

ground, and tend to induce farmers to keep the standard of beef high as the demand for graded meat increases.

APPENDIX TO MARKETING LEAFLET 13

STATUTORY GRADE DESIGNATIONS AND DEFINITIONS OF QUALITY FOR HOME-KILLED BEEF

Grade Designation	Definition of Quality
SELECT	A steer or maiden heifer beef carcass having excellent conformation, finish and quality, which are broadly indicated by the following characteristics. The carcass should be relatively short and stocky and heavily and uniformly fleshed. Rounds, loins and ribs should be extremely well developed and rounded. Chucks and plates should be ususually thick, compact and heavily fleshed. The neck should be very short and plump; shanks short and exceptionally well muscled. The superior muscular development of the round, extending well down towards the hock joint, should yield much beyond the average proportion of flesh in that cut. The spinal processes of the chine bones should terminate in fresh, pinkish white cartilages. The finish should be ideal, fat being neither excessive nor deficient. The exterior surface of the carcass, including shanks and neck, should be entirely covered with smooth fat that is not excessively thick or wasty at any point, the greatest breadth—which should not exceed ¾ inch—being over the loins and ribs; the interior walls should be well covered. Cod fat, or, in the case of a maiden heifer, udder fat, and kidney, aitch and other interior fats should be abundant but not excessive, also firm and ripe. The flesh should be firm, velvety, very finely grained and of a light rosy or cherry red colour and in the thicker cuts should possess an abundance of marbling.
PRIME	A steer or maiden heifer beef carcass having good conformation, finish and quality, which are broadly indicated by the following characteristics and are, in all respects, somewhat above the average. Rounds should be reasonably thick and heavily muscled; loins and ribs should be moderately full and plump. Chucks and plates should be broad and moderately thick. The neck should be moderately short and thick.

Grade Designation	Definition of Quality
PRIME	The fat covering should extend well over most of the exterior surface, and generally be firm and smooth, but may be somewhat patchy, especially over the rumps, loins, ribs and shoulders. The neck and lower part of the rounds, shoulders and shanks generally may have little fat covering. Cod fat, or, in the case of a maiden heifer, udder fat, and kidney, aitch and other interior fats may be either in moderate supply or somewhat excessive. Interior walls of the fore-quarters may be only partially covered. Usually the fat should be firm, brittle and reasonably white, but may have a slightly higher colour. The flesh generally should be moderately firm, the colour ranging from a light cherry red to a slightly darker red. The " eye " of the rib and loin should be above the average in thickness. Some marbling should be present in the thicker cuts.
GOOD	A beef carcass having broadly the following characteristics. It may be slightly irregular or rough in conformation and quality, but it should be reasonably well finished. The frame may be slightly angular, the bones relatively prominent, the back slightly irregular, chucks and plates proportionately large, shanks and neck long, and rounds long and tapering. The fat covering should be fair, and there should be at least a small amount of cod (or udder) and kidney fats; other interior fats should be present. The flesh, however, should be of average thickness. In all, the carcass should be of average quality. Cow carcasses in this grade should have good conformation, except for a slight depression just in front of the rump. The loins and ribs should be relatively thick, and the rounds, while heavy, may be slightly lacking in depth. The shanks may be relatively long and tapering. With the exception of the neck and shin the carcass should be well covered with fat. There may be an inclination to patchiness on the loins and rump. The interior fats should be either in moderate or good supply, and should be of average quality. The aitch bone when cut through should show gristle.

APPENDIX A

Flesh and Fat Characteristics of Various Domestic Animals

Animal	Fibre	Colour	Consistence
Flesh.			
Horse.	Coarse.	Dark, becoming black on exposure.	Soft.
Cattle.	Fine.	Bright red, marbled with fat; darker in bull; pale in calves.	Firm and elastic; less firm in calves.
Sheep.	Fine.	Rich darkish red; paler in lambs.	Firm.
Goat.	Less fine than sheep.	Darker than sheep.	Firm and has hairs often clinging to it. Odour characteristic.
Pig.	Fine.	Pale.	Less firm than sheep. Boar flesh has a distinctive odour.
Dog.	Fine.	Darkish.	Fairly firm. Odour characteristic.
Cat.	Fine.	Dark.	Soft. Distinctive odour.
Rabbit.	Very fine.	Pale.	Firmish with very little fat.
Fat.			
Horse.	—	Yellow.	Soft, oily, and sets badly.
Cattle.	— —	Pale white, yellow from age, feeding, or breeding.	Firm, sets well.
Sheep.	—	Very white.	Hard and sets well.
Goat.	—	Similar to sheep.	Softer than sheep. Little fat under skin.
Pig.	—	White.	Soft and sets less well than sheep fat.
Dog.	—	White.	Soft, oily, and has a distinctive odour.

APPENDIX B

TABLE OF SEX CHARACTERISTICS OF SLAUGHTERED ANIMALS

General Structure.

Bull.—Bones strong. Muscles well developed. Flesh almost down as far as the hock joints. Thighs full and round. Crest of the neck marked, spanned by the hand.

Ox.—Bones well developed but less than those of bull. Flesh not down to the hocks. Thighs less round. Neck less crested, spanned by the forefingers and thumb.

Cow.—Bones smaller. Musculature less full. Thigh flatter and in old cow concave. Neck flat or concave.

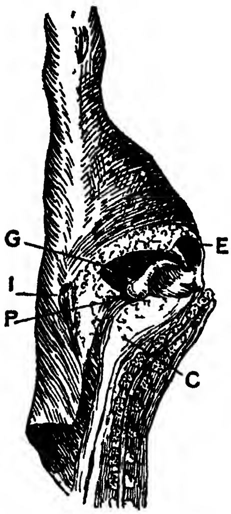
Pelvis.

BULL.—Aitch or pubic bone well developed. Pelvic cavity fairly narrow and with little fat. Muscles round the aitch bone more or less triangular.

OX.—Aitch bone less developed. Pelvis smaller than bull and well filled with fat. Muscles round the aitch bone triangular.

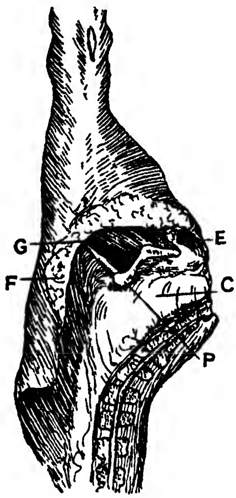
COW.—Aitch bone smaller and thinner at the anterior end. Pelvis cavity large, and with little fat contained. Muscles around the aitch bone bean-shaped.

HEIFER.—Smaller than the cow and more fat in the pelvis. Muscles around the aitch bone bean-shaped.



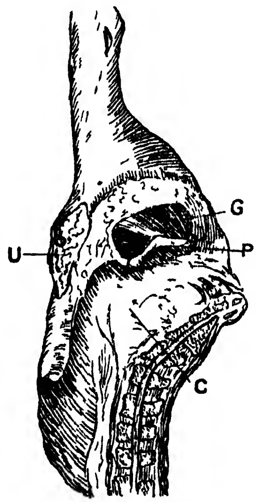
Bull

Note triangular gracilis (G) Developed erector penis muscle (E) Pubic bone with marked tubercle (P) Inguinal canal (I) Relatively narrow pelvic cavity (C)



Ox

Note triangular gracilis muscle (G) Slightly developed erector penis (E) Pubic bone with definite tubercle (P) Presence of cod fat (F) Relatively narrow pelvic cavity (C)



Cow

Note bean-shaped gracilis muscle (G) Pubic bone with no tubercle (P) Udder (U) Wide pelvic cavity (C) (If the udder has been removed a triangular-shaped space will be seen)

Sexual Organs.

BULL.—Little scrotal fat. Root of penis present and groove where the organ was removed both large. Erector muscles well developed.

OX.—Cod fat lobulated, plentiful and pointed. Penis generally left in situ. Erector muscles small.

COW.—Udder if present dark and with little fat in old animals. Triangular area in place from which udder has been removed when not in situ.

HEIFER.—Udder small, smooth, and white.

Flesh and Fat.

BULL.—Dark coarse-grained flesh and little intermuscular fat. Fat white and scanty.

OX.—Flesh finer, bright red, marbled with fat, and firm. Fat firm and white.

COW.—Flesh fibres fine, meat softer, little intermuscular fat (flesh dark in old cows). Fat soft and yellowish.

HEIFER.—Flesh fibres finer, softer than ox, and bright red. Fat may be little and may appear as marbling in muscles.

Sheep.—The general characteristics which distinguish the sexes in cattle are seen in sheep also.

The ram is better developed, has larger bones and muscles than the ewe or wether, the erector muscles are well developed, and the root of the penis can be distinguished. The erector muscles of the wether are little developed and the intact penis will generally be found on the carcass. The udder of the ewe can be distinguished and a triangular area marks the site if it has been removed.

Pigs.—The head of the boar with its large tusks will easily be recognized and the marked development of the shoulder muscles or " shield ", and the presence of the root of the penis and the large erector muscles aid in its recognition. The small penis of the hog and undeveloped erector muscles distinguish it.

The development of the teats of the sow distinguish it from boar or hog, whose teats are small and undeveloped.

APPENDIX C

ON THE KEEPING OF RECORDS OF DISEASED MEAT

In view of the fact that disputes not infrequently arise in connexion with the condemnation of diseased meat, it is important that records should be kept systematically showing the exact distribution of disease in any carcass found to be, in whole or in part, unfit for the food of man. This is now conveniently and rapidly performed at several public abattoirs by means of an outline diagram of a carcass showing the chief lymphatic glands and other important structures. So far as the writer is aware, this method of keeping graphic records was first adopted by Dr. Wilson, the County Medical Officer of Health of Lanarkshire, and it is with his kind permission that the accompanying form—which represents, with slight modification, that used at the public slaughter-houses in Lanarkshire—is here reproduced. It will be observed that on one side of the form there is an outline diagram of a carcass, and on the other a series of

No..................

Disease.

....

....

Precrural.....................

Popliteal ....

Suprapubic..................

Inguinal ....

Iliac.........................

Lumbar { ....
....

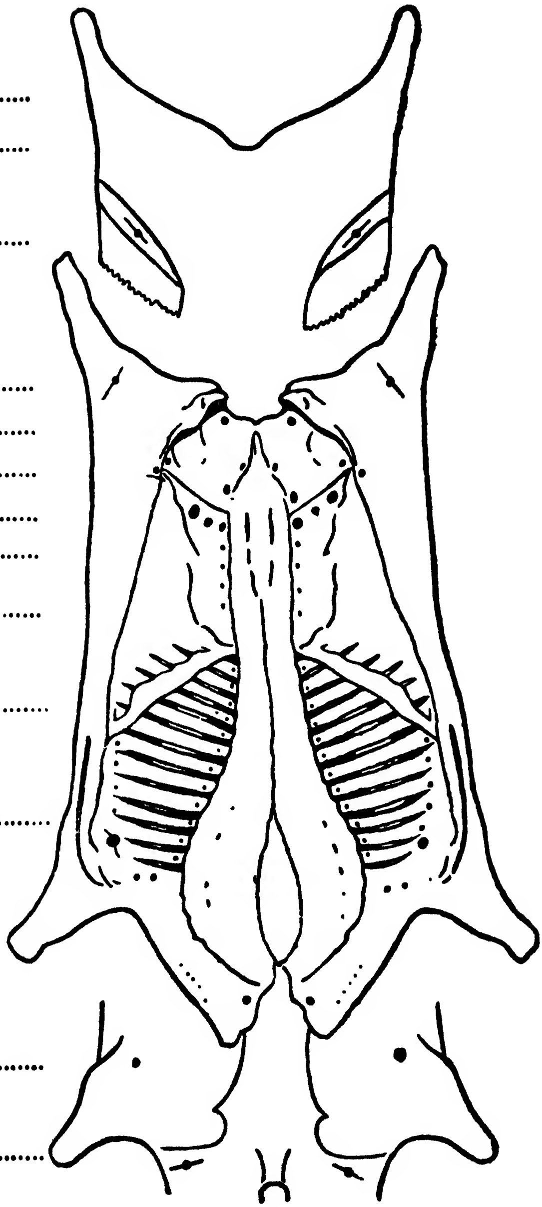
Thoracic { ....
....

Prepectoral ....

Cervical.............

Brachial ....

Prescapular...............



Carcass of.............. **Age**.......... **Slaughtered**..................

Owner....................... **Bought at** ....

Insurance Co. ....**Sale No**................. **Stamp** ....

Condition ....

Head Glands, Pharyngeal.....................

Submaxillary............................ Parotid ....

Tongue, Surface .... Substance ....

Lungs—	Left.	Right.
Surface	....	....
Substance	....	....
Glands, Bronchial	....	....

Anterior Mediastinal .... Posterior Mediastinal ....

Heart, Surface........................ Glands.......................

Liver, Surface .... Substance ....

Glands ....

Stomachs, Surface.................... Glands.......................

Intestines, Surface.................... Glands.......................

Spleen, Surface .... Substance ....

Uterus, Surface...................... Interior ....

Udder, Substance .... Glands.......................

Quarters affected ....

Kidneys, Cortex .... Medulla ....

Bones ....

Remarks ....

Decision ....

Weight of Carcass ....Cwt.........Qr.........Lb.

Weight of Condemned Meat................ „ .... „ .... „

„ „ Fat................. „ .... „ .... „

Date............................. **Signature** ....

headings referring chiefly to the condition of the internal organs. The diseased portions of a carcass may readily be indicated on the diagram in red ink, and when the other particulars contained on the form are filled in a very complete record of the circumstances connected with the diseased animal is obtained.

(See also the Second Schedule to the Public Health (Meat) Regulations (Scotland), 1932, p. 425.)

Section IV.—Slaughter and Slaughter-houses

CHAPTER I

Slaughter of Animals

Transport to Place of Slaughter—Period of Rest—Aims of Slaughter—Avoidance of Pain—Efficient Bleeding.
Methods of Slaughter: Shooting Instruments—Free and Captive Bolts—Site of Election.
Slaughter by Electrocution: Neck Stabbing—Jewish Mode of Slaughter—Slaughter of Sheep, Pigs, and Calves.
Blood Splashing—Over-sticking—Emergency Slaughter.

TRANSPORT TO PLACE OF SLAUGHTER

Animals are transported for slaughter, in this country, by road, rail, or sea. Those brought by road are walked, if the distance allows, or are carted or conveyed by motor. Beasts transported by rail are accommodated in trucks which are loaded broad-side on. In America and Australia the animals are put in at one end of a wagon and are walked from wagon to wagon, the length of the train. As each wagon is filled it is shut, and the next is filled, and so on till the train becomes "loaded". "End to end" loading is preferable to broad-side loading as the former requires no force and little handling of the animals. In boats separate compartments are provided for the beasts, but in rough weather the animals are liable to injury.

During transport animals should be handled as quietly as possible; all excitement and excessive handling should be avoided. Bruising spoils the flesh, and bleeding is less complete in animals which have been excited. Over-fatigue is undesirable as the flesh of tired animals keeps less well and is not so efficiently bled. The muscles become hard and tough in beasts which have been walked long distances, even if fatigue is prevented. Cobbled streets, &c., should be avoided, so far as practicable, as animals are apt to slip and fall and fracture of the pelvis may result, when they are driven over wet and slippery sets. (See Slaughter of Animals Act, 1933, Second Schedule 1(*a*), p. 443.)

Period of Rest.—No animal should be slaughtered until it has rested for a period of at least 12 hours at or near the slaughter-

house. During this time it should fast, or at most have small feeds of hay, but water should be given as required. Each species of animal should be kept apart, and it is preferable that the sexes should be separated. Further, a restive or excited animal should, if possible, be kept from others; any factor contributing to restlessness and excitement should be excluded. Precautions must be taken to prevent animals awaiting slaughter from seeing others slaughtered, and from seeing or smelling blood, and they should be kept cool and in the shade. Non-observance of the above conditions is believed to have a detrimental effect on the keeping quality of the meat. (See Slaughter of Animals Act, 1933, Second Schedule (2), (4), and (6), p. 443.)

SLAUGHTER OF ANIMALS

The total number of animals slaughtered in Great Britain in the year 1928–29 was 2,118,000 cattle, 1,097,000 calves, 11,083,000 sheep, and 4,566,000 pigs, giving a total of 18,864,000 animals.[1]

In the slaughter of animals two main objects should be aimed at, namely, (*a*) all unnecessary pain must be avoided, and (*b*) bleeding should be as complete as possible.

(*a*) **Avoidance of Pain.**—The slaughter of animals in Great Britain is now regulated in England and Wales by the Slaughter of Animals Act, 1933, and in Scotland by the Slaughter of Animals (Scotland) Act, 1928. Under the provisions of these Acts, every animal (to which the Acts apply) which is slaughtered in a slaughterhouse or knacker's yard must be instantaneously slaughtered, or shall by stunning be instantaneously rendered insensible to pain until death supervenes, by a slaughterman, licensed by the Local Authority, who shall use for the purpose a mechanically operated instrument in proper repair.

In England and Wales, sheep and swine may be exempt from these provisions:

(i) Sheep are exempt unless the Local Authority passes a resolution applying the provisions to the slaughter of sheep in their area.

(ii) Swine are exempt in cases in which there is not available a supply of electrical energy unless it is proved that such a supply could reasonably have been made available.[2]

[1] *Report of the Committee of the Economic Advisory Council on the Slaughtering of Livestock*, 1933.

[2] See p. 443. Under the Slaughter of Animals Act, 1933, "mechanically operated instrument" includes an instrument for stunning by means of electricity.

In Scotland, swine are exempted from the above provisions. In England, Wales, and Scotland exception is made in the case of animals slaughtered by the Jewish method for the food of Jews, and by the Mohammedan method for the food of Mohammedans, provided the slaughtering is carried out without the infliction of unnecessary suffering.

(*b*) **Bleeding.**—The keeping quality of meat depends mainly upon the amount of moisture in the flesh, or in other words, upon the amount of blood in the vessels. Various bacteria responsible for decomposition and putrefaction require moisture for their existence and multiplication. In the carcass this is derived mainly from the blood; it follows therefore that imperfectly bled carcasses are liable to decompose more rapidly than those having the minimum of blood left in the vessels of the tissues. Even after the most thorough "bleeding" a certain amount of residual blood remains in the organs, but when squeezed no blood points should appear on the cut surface of an organ of a well-bled animal, and there should be no signs of bleeding if an incision is made into the muscles or flesh.

Several factors influence bleeding, such as fatigue, feeding, excitement, disease, &c. Animals should be rested before slaughter; they should not be excited as the temperature will tend to rise and bleeding will be hindered. They should fast for 12 to 24 hours in order that engorgement of the blood-vessels may be avoided, but should be given copious draughts of water to wash out the digestive tract. Drovers should avoid rough handling, or beating of the animals, as, apart from the needless cruelty inflicted, this results in congestion of blood in the injured parts or even bleeding into the tissues.

The flesh of an incompletely bled animal, or of one that has died from natural causes, is darker in colour and has a larger blood content than normal. The vessels beneath the skin and those connected with the viscera are found distended with blood; such carcasses have a bad appearance and decompose rapidly.

METHODS OF SLAUGHTER

The methods of slaughter adopted vary greatly, not only in different countries, but also in Britain; all may, however, be divided into (*a*) those in which the animal is rendered unconscious before being bled, and (*b*) those in which it is bled without previous stunning.

SLAUGHTER BY MEANS OF INSTRUMENTS WHICH RENDER THE ANIMAL UNCONSCIOUS

Under the legislation now in force in this country it is, save for the provisos to which allusion is made on p. 202, from the 1st January, 1934, illegal to use any instrument for the slaughter of animals other than a mechanically operated instrument.

Mechanically Operated Instruments.—These are sometimes known as " humane killers ", and are of two kinds: those which discharge a free bullet, and those which effect their purpose by means of a " captive bolt " arrangement. In the use of the latter the animal is stunned by a bolt which is shot into the skull by the discharge of a cartridge and automatically withdrawn therefrom by means of the recoil.

Shooting Instruments with Free Bullets.—All instruments with free bullets have one objection in common, namely, that, should they be carelessly applied, or should the animal be restive or suddenly move its head, the bullet may deviate from its course and injure someone, either by direct shot or by ricochet.

Greener's Humane Cattle Killer consists of a short rifled barrel chambered to receive a small cartridge with a steel-pointed bullet. It is terminated by a bell-shaped chamber, which serves to deaden the sound, protect the operator from the flash of the explosion, and to direct the bullet through the brain into the spinal cord, thus avoiding the necessity of pithing. The animal is killed instantly, and can be bled without danger.

The cartridge is contained in a chamber and is kept in position by means of a cap, in which is the firing pin. A safety loop protects the operator and should not be removed until just before firing, when the pin is struck by a wooden mallet. As will be seen, the head of the animal must be in a suitable position and must be kept still; this may be effected by means of roping, by a rope attached to a ring, or, best of all, by the use of a stunning pen. Both hands of the operator are required, one to hold the instrument, the other to strike the pin with the mallet.

Swedish Killer.—An instrument similar to the Greener Killer, except that instead of a protecting cap there is a spring on the firing pin which keeps a knob in position and which must be pulled to one side before the pin is struck with the mallet.

Spragg Pistol.—A pistol firing a free bullet which is discharged by pulling a trigger as in an ordinary pistol.

R.S.P.C.A. Humane Killer and Slaughtering Pistol.—The slaughtering pistol consists of a revolver with a rounded expanded end

which enables it to be pressed correctly upon a chosen spot. Graded smokeless cartridges are provided for use on various sized animals.

Fig. 1.—Stunning Bullock with Greener's Humane Killer

The large humane killer is similar in principle, the revolver being mounted on a wooden shaft through which runs a wire attached to the trigger. The operator stands facing the same way as the animal to be

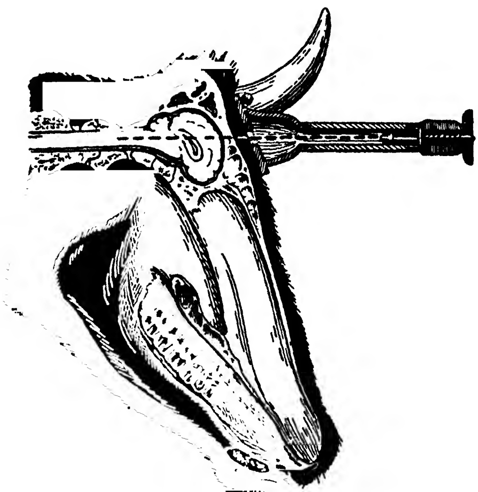


Fig. 2.—Section of Bullock's Skull, with Greener's Apparatus in position

slaughtered, and, placing the rounded end of the revolver on the selected spot on the animal's head, fires the instrument through the agency of the wire attached to the trigger. An advantage of the killer is that there is no risk of the animal falling against the operator.

Shooting Instruments with Captive Bolts.

The Cash Captive Bolt Pistol is on the same principle as a pole-axe, but is mechanical, resembling an automatic pistol. By the explosion of a cartridge fired as in an ordinary pistol, a bolt is driven with great force into the skull of the animal, penetrating to a depth of from 2½ to 3 inches. The bolt returns automatically into the pistol barrel with the recoil. Blank cartridges of various strengths to suit the size of the animal to be shot are available.

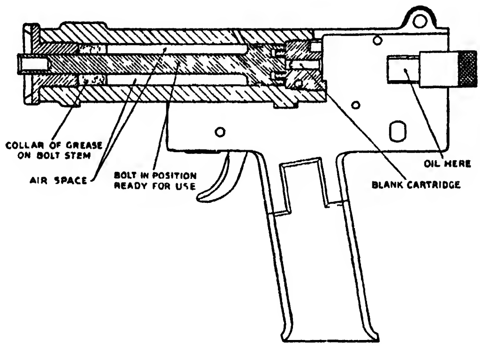


Fig. 3.—Cash Captive Bolt Pistol

Schermer Humane Killer is greatly used on the Continent. The principle on which it works is that of a captive bolt; a large killer is provided for cattle, and a smaller size for pigs, &c., with appropriate cartridges. The instrument has the advantage of being almost noiseless when fired, and easy of operation.

Temple-Cox Patent Killer.—Several instruments of the Temple-Cox pattern are on the market, but the " new universal model " has superseded former ones.

The new model can be used as a pistol or may be attached to a long firing handle, as desired. The instrument is a captive bolt killer, the bolt being discharged by the firing of a small or large cartridge according to the size of the animal to be slaughtered. It is stated to be easy to handle, easy to clean, and to be " extremely " quiet when fired.

Site of Election for Shooting.—In cattle this is a point on the forehead which may be found by drawing lines from the base of each horn to the eye on the opposite side, the spot at which these lines intersect being the " vulnerable spot ".

In sheep without horns a point is selected in the centre of the front of the head between the ears, and the shot is fired in the direction of the gullet. In rams or sheep with horns, a point is taken in

the centre line just behind the ridge which runs between the bases of the horns, and the aim is directed towards the gullet. In the pig a point is selected about one finger's breadth above the level of the eyes, half-way across the forehead, and the aim is directed into the head.

The head of the animal should be securely fastened.—The Second Schedule to the Slaughter of Animals Act, 1933, provides, inter alia, that "before an animal is stunned the head must be securely fastened in such a position as to enable the animal to be felled with as little pain or suffering as practicable". (See stunning pens, p. 219.)

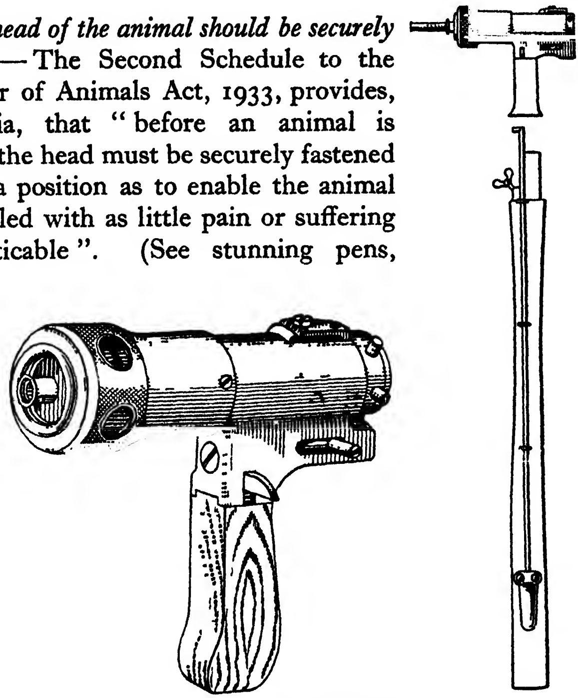


Fig 4—Temple-Cox Patent Killer

Stunning by Means of Electricity.

The electric method of stunning is now used in many places in this country for rendering pigs unconscious before they are bled. The method has not yet been extensively applied to cattle or large animals. The principle involved is that of passing an electric current of low voltage through the animal, rendering it instantaneously unconscious, in which state it remains for about five minutes, during which time it can be hoisted, removed to the bleeding station, and bled.

Animals are relatively susceptible to electric currents, and, if too high a voltage is used, fracture of bones and injuries from violent muscular contractions may occur. During the experimental period

it was averred that "splashing" (see p. 210) was liable to occur, and that bacon from pigs stunned by the electric method would be unmarketable. This has proved to be incorrect, and in many bacon factories all pigs are now stunned by electricity prior to being bled.

A number of instruments are on the market, but a description of one will suffice. The main drawback to their use has hitherto been that of expense, but cheaper models are being produced which will probably lead to more extensive adoption of the apparatus. The great advantages of the method are that there is no squealing, struggling, or kicking, no signs of blood, no violent striking with mallet or hammer, and no sound of shot from the use of a gun, as in other methods of stunning.

THE HIGGS ELECTRIC LETHALER.—This apparatus consists of a transformer from which an insulated lead connects with the electric current. From the transformer a second insulated lead conducts the current to one handle of a pair of tongs, at the ends of which are fixed electrodes or gripping devices rather like the ear-phones of a wireless set, on each of which are a number of short teeth. The operator grips the pig behind the ears with the electrodes, and allows the current to pass into the animal by operating a switch from the handle of the tongs. The current of low voltage of about 70 to 80 volts is applied for about 5 seconds (longer if the animal is large) and the pig slowly rolls over unconscious. The period of unconsciousness lasts about 5 minutes, during which time the animal lies perfectly still and anæsthetized, and can be hoisted and stuck before consciousness returns. Bleeding is reported to be good, and "splashing" does not occur.

Having regard to the ease with which they are used, their effective action, and to the fact that all animals may be readily stunned by them, there is no doubt that, from the humanitarian point of view, the use of a modern mechanical killer or electric lethaler is the ideal method of stunning animals prior to slaughter. It is sometimes contended by butchers that bleeding by this method of stunning is less complete, and that "splashing" is liable to occur in pigs which may interfere with the dry curing of bacon. It appears doubtful, however, whether there is much force in these contentions, and it is to be hoped that the day is not far distant when some form of humane killer or electric lethaler will be in universal use for *all* animals.

Bleeding.—Immediately after the animal has been stunned, it is bled. Various devices have been invented for hoisting the animal and conveying it to the bleeding place; no matter which is

chosen, the main endeavour should be to lose as little time as practicable between the moment of loss of consciousness and the onset of bleeding. In some places calves and pigs are hoisted by their hind-legs before being stunned so as to expedite bleeding.

SLAUGHTER WITHOUT PREVIOUS STUNNING

Jewish Method of Slaughter.—In the Jewish method of slaughter the animal's throat is cut without any preliminary stunning. A blow on the head is not considered permissible by the Jewish people, because perforation of the brain membranes belongs to the eight mutilations which render meat unfit for food.

In practising this method the animal is first thrown on its side and fixed there. This is generally accomplished by windlasses fastened to the walls or ceiling of the slaughter-house. The head is then placed so that it rests upon the horns and nose, after which the throat is cut by a very sharp knife, all the structures down to the vertebræ being severed in the process. (See note on Weinberg casting pen, p. 220.)

To see an animal killed by this method is certainly a repulsive sight, yet perhaps the look is the worst part of it, because the bleeding induces a general anæmia of the brain with rapid loss of consciousness. It is claimed that rigor mortis sets in more rapidly when the Jewish method is employed and that meat from such carcasses keeps better.

Slaughter of Sheep and Pigs.

Sheep.—Sheep are often killed in England by bleeding without previous stunning. The animal is laid either on the ground or on a " crutch ", three legs are tied, or it is held by an assistant; the neck is forcibly extended, and a sharp-pointed knife is thrust through the neck behind the ears, which severs the chief blood-vessels. Immediately these have been cut, the knife is turned in the cut and pushed between the junction of the head and the vertebræ, severing the spinal cord; or, the head of the sheep is held firmly in the left hand while the knee is placed on the back of the animal, and with the right hand the nose is pulled backwards till the neck is broken.

It is claimed that stunning or shooting is liable to damage the head, which is used for food, but many of those who have had experience in the killing of sheep with a mechanical instrument deny that the damage to the head is serious.

PIGS are sometimes killed by bleeding without previous stunning, or are stunned by means of a flat hammer, the pole axe, humane killer, or the electric method, and are then bled. They may be bled on the floor, but in many bacon factories and modern abattoirs all pigs are hoisted to a bleeding rail by means of a chain fastened round a hind-leg, and bled while so suspended. The head is extended and an incision made, with a sharp knife, down the neck from the throat for about 4 inches. The animals are sometimes hoisted and bled without previous stunning, but in many of the larger and more modern slaughter-houses they are stunned by the electric method or captive bolt before hoisting, so that the animals are unconscious during both hoisting and bleeding operations.

Blood Splashing consists of areas of hæmorrhage in various parts of the carcass; they are most characteristic when they occur on the diaphragm as " brush marks ", but may appear as red spots or as linear hæmorrhages. In the pig the spots are common in the shoulder and neck regions, the chest wall, and the fat lining the abdominal wall (leaf lard).

When the brain centre for the heart-beat (situated in the medulla) is destroyed during stunning or shooting, the heart, no longer under control, beats very rapidly, the blood pressure becomes raised, and rupture of the smaller vessels is apt to occur. The blood may ooze into the tissues, giving rise to areas of hæmorrhage, known as "splashing ". The condition is most commonly seen in fat pigs, and bacon cured by the " dry " method is rendered unsightly and even unmarketable when " splashing " is present.

Back-bleeding, Back-sticking, or Over-sticking.—It may happen that in sticking an animal the operator inserts his knife too far, so that it punctures the pleura, penetrates the thorax, and allows the blood to run backwards into the chest cavity, causing the internal walls of the thorax to become covered with blood and blood clot. This condition is spoken of as " back-bleeding ", " over-sticking ", or " back-sticking ". Such a carcass is unsightly and unless washed or " stripped " it may be unmarketable.

In Memo. 62, Foods, *B*, stripping of the serous membranes is permitted by or under direction of the meat inspector in cases of " back-bleeding ". If immediate stripping is necessary in order to preserve the marketability of the carcass, the membrane should not be entirely detached from the carcass until the meat inspector has examined it or authorized its detachment. (See p. 166.)

EMERGENCY SLAUGHTER

Animals may be subjected to emergency slaughter in order, as it is sometimes quaintly put, " to save their lives ". In the case of mechanical injuries such as fractures, penetrating wounds, &c., resort is often had to emergency slaughter. If this is carried out at once, the flesh, except for any injured part, may be fit for human food, but, should it be postponed, sepsis may set in and render condemnation of the entire carcass necessary. On the other hand, animals suffering from illness are sometimes slaughtered when they are at the point of death, in order that some degree of " bleeding " may be effected, and the carcass may appear fit to be put on the market. Such carcasses, as well as those of animals that have died from natural causes, should always be condemned, because the disease that caused the death of the animal may render the flesh dangerous to man, and, as the " bleeding " will in any case be deficient, decomposition rapidly ensues and renders the meat unfit for food.

CHAPTER II

Slaughter-houses

Private Slaughter-houses—Public Abattoirs—Construction—Buildings, &c. By-products. Preparation of Tripe and Sausage Skins, &c.

Private Slaughter-houses.—" Slaughtering is conducted in England and Wales either in public or private slaughter-houses. The former are the property of the Local Authority of the area concerned. The latter, of which there are about 16,000, are of many types and vary greatly in efficiency, being usually the property of individual and retail butchers. They must either (*a*) be registered, (*b*) hold a licence without limitation of time, or (*c*) hold a licence for a limited period, usually one year. The number of animals, excluding pigs killed for bacon, killed annually in private slaughter-houses is about 9,500,000 head."

" Registered slaughter-houses are those which have been continuously in use from the date when the relative provisions of the Towns Improvement Clauses Act, 1847, came into operation in the area. The right to slaughter in registered slaughter-houses is attached to the premises and is independent of the occupier. Slaughter-houses hold a licence without limitation of time if they were first used after the critical date referred to above, but before the provisions of the Public Health Acts Amendment Act, 1890, came into operation. In law licences of this kind strictly attach to the premises and the occupier jointly and lapse on the termination of the occupier's interest in the property. In fact, however, these licences have, we understand, been treated by local authorities as though they related to the premises alone. Premises first used for slaughtering after the adoption by the local authorities in question of the provisions of the latter Act have only an annual licence. Of the 16,000 private slaughter-houses in existence, approximately 9000 are registered, the remainder being either licensed without limitation of time, or holding an annual licence."

Public Slaughter-houses or Abattoirs.—"There are 115 public slaughter-houses in England and Wales. Most of the largest towns have already built one. But among the towns of under 100,000 inhabitants, those having no public slaughter-houses are in the majority. Some public slaughter-houses are very small, killing less than 5000 animals of all kinds in a year."

"In Scotland, public slaughter-houses are of much greater relative importance than in England. Of the 153 public slaughter-houses in Scotland, 129 are situated in burghs and 24 in counties. Nearly all burghs, even those with a population of under 5000 persons, have a public slaughter-house. The provision of the Burgh Police (Scotland) Act, 1892, that where a town council has established a slaughter-house no other premises may be used for that purpose within the burgh, and that no compensation need be paid for the closing of private slaughter-houses, has been of great assistance to the Scottish local authorities. In the county areas where the above provisions do not apply slaughtering is still largely carried on in private slaughter-houses. Of these there are 431 which are licensed. In addition to the slaughter-houses which mainly concern themselves with a slaughtering for local consumption, there are, notably in Aberdeen, a certain number of slaughter-houses which are principally used for killing for the export trade to England. Over 90 per cent of the home-killed meat consumed in Scotland comes from public slaughter-houses." [1]

Advantages of Abattoirs and Disadvantages of Private Slaughter-houses.—Among the objections to private slaughter-houses the following may be mentioned. They may be insanitary owing to unsuitable construction and difficult to keep clean. Provision for the satisfactory storage of meat may be lacking. They are sometimes situated too near dwelling-houses and may give rise to nuisance from noise or from smell resulting from storage of offal, &c. Animals may be kept in lairs in the vicinity of dwellings and the means of access may be awkward. Their use frequently involves the driving of animals through streets. Adequate inspection of meat is rendered difficult owing to the number of private slaughter-houses and the varying times of slaughter.

The advantages of public over private slaughter-houses are many; the chief of these are: (*a*) centralization of slaughtering, (*b*) greater ease and efficiency of inspection, (*c*) slaughtering and dressing of

[1] *Report of the Committee of the Economic Advisory Council on the Slaughtering of Livestock*, 1933.

carcasses under sanitary conditions, and (*d*) the driving of animals through streets is avoided if the abattoir is erected on a suitable site.

ABATTOIRS

The following are some of the more important considerations in connexion with the erection of a public abattoir.

Site.—Abattoirs are generally built on the outskirts of towns, but should be within easy reach of the butchers' shops in order to reduce to a minimum the cost of transporting meat. Abattoirs are frequently situated close to cattle markets, and this is a convenient arrangement because animals bought by the butchers at the market can be moved to the abattoir with a minimum of trouble and expense. If a substantial proportion of the animals is brought in by rail, the abattoir may with advantage be provided with railway sidings; in seaport towns, where cattle are brought by sea, it may be situated near to the docks. The site should always be sufficiently large to leave room for any future extensions that may be required. It is very important to select a clean site, i.e. one free from serious atmospheric pollution and not subject to falls of grit or smuts.

An abundant water supply is essential, and no site should be chosen where this cannot be secured.

In considering the suitability of a site, the disposal of the abattoir sewage must always be borne in mind. If no conveniently situated sewer is available, the site must be sufficiently large and possess adequate natural fall to permit of the abattoir having a sewage purification plant of its own.

I. Main Departments.

1. Lairage accommodation, consisting of pens in which the live animals are kept prior to slaughter.

2. Buildings in which slaughtering is carried on. (*a*) The cattle slaughter-hall, which may also be used for the slaughter of calves and sheep. (*b*) A separate hall for the slaughter of pigs.

3. Cooling hall in which carcasses are hung until removed by the butchers.

4. Hide store.

5. Manure house in which dung and the contents of stomach and intestines are retained until removed. It is an advantage to store manure in movable and washable containers.

6. Detention room in which suspicious carcasses and organs are detained for thorough inspection.

7. Condemned meat room in which condemned carcasses and organs are kept under lock and key until they are removed for final disposal.

8. Boiler house with boilers for the supply of hot water and steam for driving machinery, and for heating the scalding vats, &c.

9. Mess-room, dressing-rooms, and lavatories for butchers and their assistants.

10. Office accommodation and lavatories for meat inspectors and other officials.

11. The superintendent's office should be so placed as to command the best view of slaughtering operations and as much of the abattoir as practicable.

II. Accessory Departments.

1. Guttery, in which gut-scraping is carried on.[1]

2. Tripery, in which tripe is prepared.[1]

3. Buildings containing the " digester " apparatus for dealing with condemned meat. (The " digester " may be situated at the abattoir or elsewhere.)

4. Facilities for blood drying.

5. In large abattoirs an isolation block is provided for the observation and, if necessary, the slaughter of diseased animals. The block must be kept separate from the main buildings.

6. A superintendent's house in connexion with abattoirs is desirable.

Planning.—The first essential is to obtain accurate information respecting the number of animals likely to be killed in the abattoir, and, in this connexion, the possibility of closing private slaughter-houses has to be considered. As already stated, the Burgh Police (Scotland) Act, 1892, provides that, where any town council has established a slaughter-house, no other premises may be used for that purpose within the burgh and no compensation need be paid for the closing of private slaughter-houses. In England and Wales there is no power in the general law to enable the Authority to prohibit slaughtering in their district elsewhere than in a public slaughter-house provided by them, but such a power is possessed by some Local Authorities under local Acts. Usually, however, these

[1] Article 12 of the Public Health (Meat) Regulations, 1924, provides that no " gut-scraping or tripe-cleaning shall be carried out in any slaughter-house " (see p. 415).

Acts provide for the payment of compensation in certain cases. Presumably, where a public slaughter-house has been provided and is adequate for the service of the community, the Local Authority may properly refuse to grant fresh licences to applicants, and they may refuse to renew terminable licences, but when this happens the person aggrieved thereby has a right of appeal to Quarter Sessions.

Disposition of Buildings.—The modern municipal abattoir comprises a number of separate one-storied blocks connected, where necessary, by means of covered ways, and a system of overhead runways, or rails, is installed to facilitate the movement of carcasses from place to place and to obviate unnecessary handling. The buildings should, if practicable, be situated so as to permit of the movement of healthy carcasses in one direction to the cooling hall and of all "dirty" material (i.e. manure, stomach and intestinal contents, hides, skins, &c.) in the opposite direction to specially provided buildings for appropriate treatment or disposal.

With the view of effecting this purpose, the following system of planning has proved effective:

(*a*) Cooling hall occupying central position in front.

(*b*) Cattle and sheep block on one side of and behind (*a*).

(*c*) Pig, &c., block in position similar to (*b*) on other side.

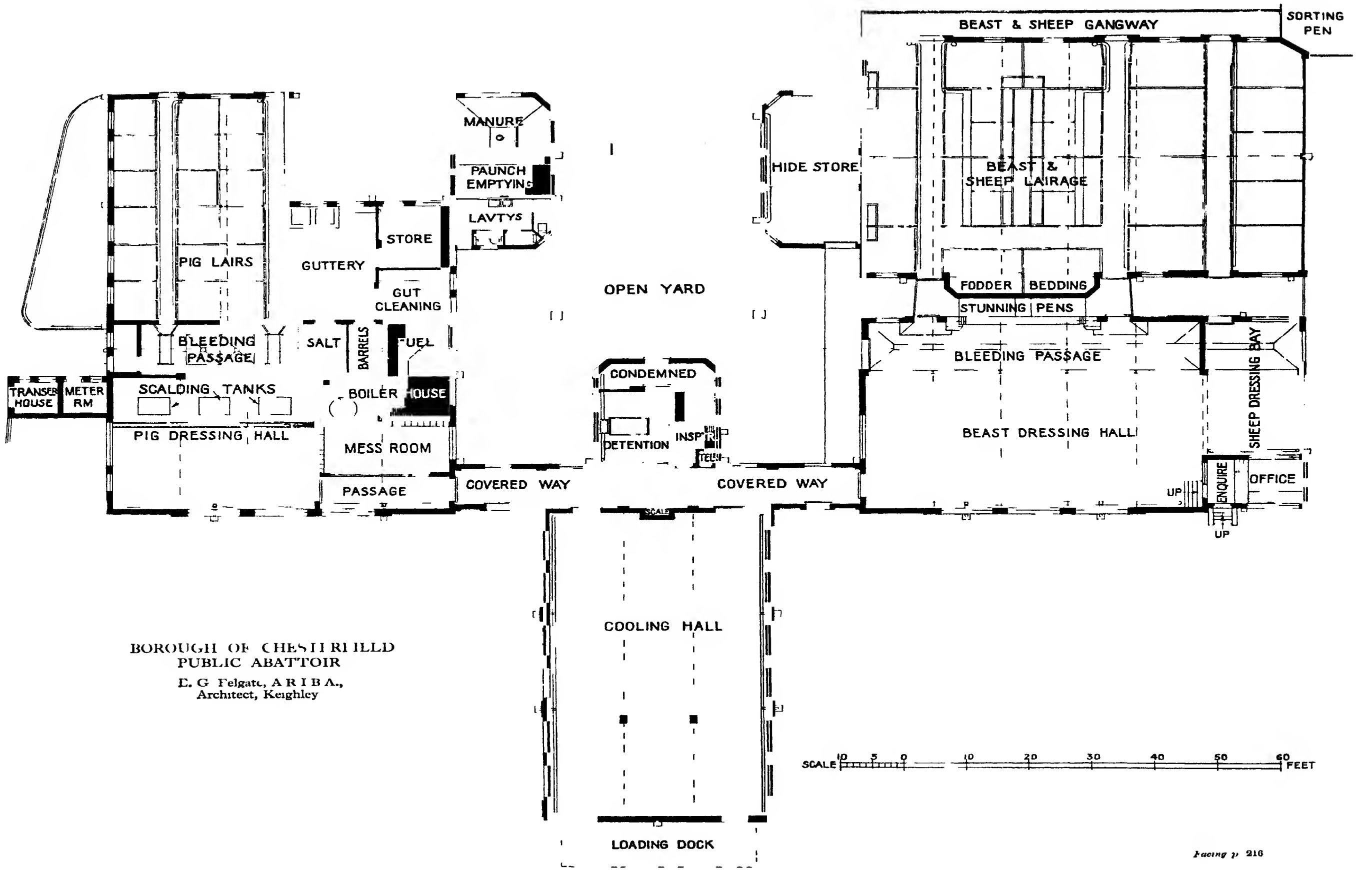
(*d*) Hide store, tripery, guttery, manure house, condemned meat room, &c., in the rear.

Adequate space should be provided for future extension of all the buildings should this be necessary.

The cooling hall or hanging room should be connected with the slaughter blocks for cattle and sheep and for pigs by means of covered ways and overhead runways so as to facilitate movement of the carcasses from the slaughter-hall. It should also be provided with a loading dock in which carcasses may conveniently be deposited in vans for transport to the butchers' shops.

The cattle and sheep block should comprise two separate buildings, one in front of the other, with an open passage between. The rear building provides lairage accommodation, while that in front is the slaughter-hall. The open passage intervening between the buildings should be about 10 feet in width.

The entrances to the slaughter-hall are placed immediately opposite the exits from the lairage. The passage at these points is sometimes roofed to afford protection from the weather. Solid barrier gates bridge the passage on either side of the covered ways, and, when in position, form a 4-feet wide alleyway for the passage



BOROUGH OF CHESTERFIELD
PUBLIC ABATTOIR
E. G Felgate, A R I B A.,
Architect, Keighley

Facing p 216

of cattle from the lairage to the slaughter-hall. To prevent animals seeing others being killed and dressed, the stunning pens are placed at the entrance to the slaughter-hall. By setting the gates in the waiting pens and passages in the required direction, the animal passes quietly from the lairage into the stunning pen, where it is stunned by a mechanically operated instrument, its carcass being thereafter ready for bleeding. Stunning pens may be of the " single way " or of the " double throw " type. In the latter the floor is pivoted at the centre so that carcasses may be discharged to right or left of stunning pen at the will of the operator. (" Single way " pens are indicated on the plan of the Chesterfield abattoir, and " double throw " pens in the illustration of the Kirkcaldy abattoir.)

The layout of the pig, &c., block should be similar to that used for cattle and sheep, but the open passage between the lairage and the slaughter-hall is often omitted. Pigs are, however, generally stunned in pig traps, or by means of an electric lethaler, and provision has to be made for scalding and scraping.

The entrance for cattle, sheep, and pigs should be at the rear of the abattoir. From thence they pass readily into the lairages, and so to the slaughter-halls from which their carcasses are conveyed on overhead runways to the cooling hall. The passage of " dirty " material is in the opposite direction. This is a matter of great importance as it facilitates cleanliness in all slaughter-house operations.

Construction and Equipment.

WALLS may be built of either stone or brick. The interior surfaces of walls in all sections other than the lairages should be of white glazed bricks or tiles. With a view to economy the glazed dado need only be carried to a height of about 8 feet from the floors, the walls above being formed of pointed brickwork in cement and limewashed. The internal walls in the lairages should be rendered to a suitable height with portland cement finished smooth.

All internal angles at junctions of walls with each other, and with floors, should be formed with hollow curved bricks, and salient angles in the brickwork at doorways, &c., should be " bull nosed ".

FLOORS throughout must be of a hard, impervious, and " non-slip " character, carefully graded and drained. They may be paved with " non-slip " tiles or stone slabs; granolithic cement, to which carborundum has been added, provides a good foothold and is satisfactory, except perhaps in the slaughter-halls where specially manufactured non-slip tiles or good stone slabs are preferable.

The lairs are sometimes paved with concrete finished with a rough surface.

ROOFS should be of steel construction, slated or tiled externally and lined internally with asbestos sheeting. The latter tends to overcome extremes of temperature.

VENTILATION.—Adequate cross ventilation as well as exhaust at the roof levels is necessary. The latter may be effected by exhaust ventilators on the ridge of the building. A tier of centre pivoted shallow sash windows are suitable in the walls, by means of which the ventilation is easily regulated and kept under control.

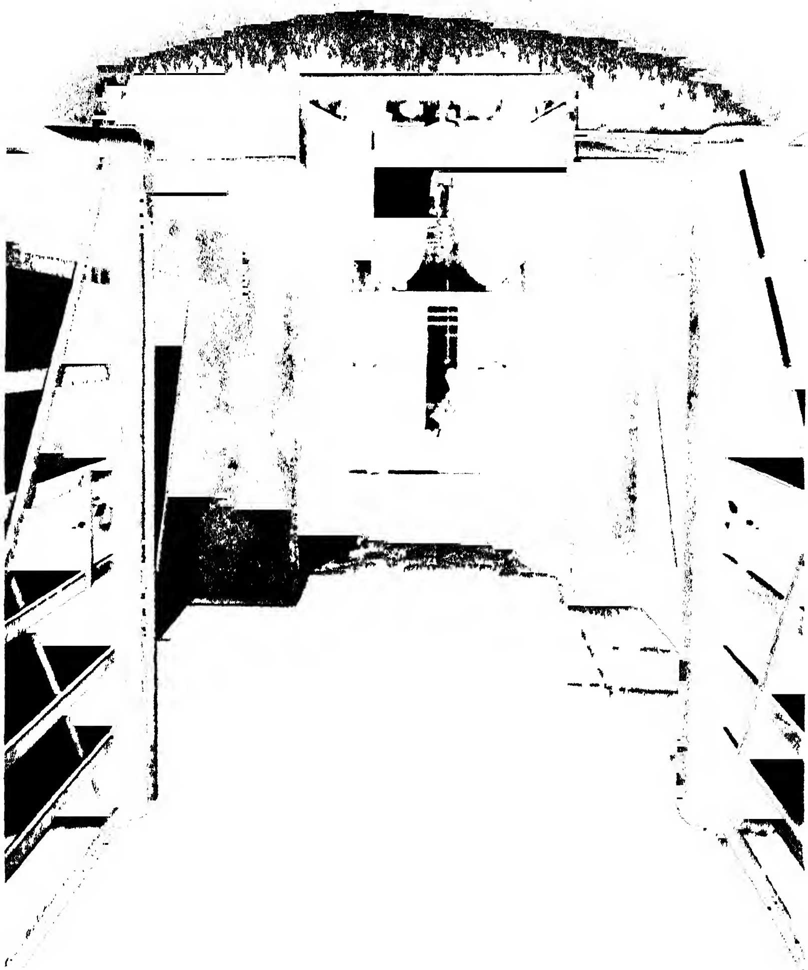
LIGHTING is sometimes effected from the roof. North lighting is desirable, particularly in the cooling hall and slaughter-halls.

Windows of the above-mentioned type are suitable in the walls. The use of blue-tinted non-actinic glass, if not essential, is at least very desirable. This glass is stated to obscure the direct rays of the sun, thus rendering the buildings cool, and to act as a deterrent to flies entering and remaining within the buildings.

Ample means of natural lighting is essential, and artificial illumination should be so contrived as to cast no shadows.

DRAINAGE.—The internal drainage should be by means of open concrete channels, and there ought to be no drain openings inside the buildings. The open channels should discharge into open gullies, fitted with lift-out grit container boxes, situated immediately outside the buildings. The usual stoneware pipes are suitable for the outside closed drains, provided they are cement jointed, and free in the inside from " rags ". Easy access is essential by inspection chambers placed at short intervals, and, where necessary, provision should be made for the interception of solids.

EQUIPMENT.—Up-to-date equipment and furnishings go far to render an abattoir clean, wholesome, and efficient. In recent years the introduction of cattle stunning pens, pig stunning traps, high-grade hand and electrically operated dressing hoists, loading hoists of the travelling type, twin-bar runways, overhead weigh-bridges, and numerous other appliances specially designed for this class of work have effected a great improvement. The system of runways, or overhead railways, should serve all parts of the abattoir and be so designed that a carcass or other load may be conveyed to any required point without being lifted from the rails. There are two types of runways, namely, the " single bar " and the " twin bar ". The latter is the more expensive, but possesses the advantage that switches are not required. Weighing may be conducted while the meat hangs



The photograph, supplied by the North British Lifting and Moving Co shows the pen open, with gates arranged for the entrance of the animal from the waiting pen The gripper device is well seen above ready to be lowered on to the neck of the beast The front opening has been left ajar and shows the operator on the far side This door is not opened normally until the animal is shut into the pen by the closing of the pen doors at the posterior end.

from the rail. This is done by "breaking" the rail and connecting the detached section to a special weighing machine which records at floor level.

Stunning Pens.

The North British Lifting and Moving Appliance Company (Glasgow) have installed cattle stunning pens in several of the Scottish abattoirs where they are in constant use. The following description is supplied by the firm:

"With these modern stunning pens there is no roping, tail-twisting, or flogging. A bullock in any part of the lairage pens or byres can be passed into the stunning pen at any of the dressing stations throughout the slaughter-hall by simply setting gates of waiting pens and passages in the required direction. From the lairage the animal passes into the stunning pen placed centrally between two dressing stations in the slaughter- or dressing-hall, and from which it cannot see either blood offal or any other disturbing element. Immediately the animal is within the stunning pen, a steel plate door is closed behind it, a "gripper device" descends and gently secures the animal around the neck. A narrow door at the front of the pen silently glides open, through which the animal is instantly stunned with the mechanical killer when it drops on the floor of the pen. By slight pressure on a lever, the carcass is discharged on to the floor in position ready for bleeding and dressing. Carcasses may be discharged to right or left of the stunning pen at the will of the operator."

Pig Traps.

In Sweden and some parts of Germany a "Gottenberg" pig trap is in use. It consists of an iron chamber at the fore end of which is a hole large enough to allow the pig's head to pass through. The pig is driven into the trap as far as possible so that its head protrudes through the opening, the trap is closed behind the animal, by which means it is firmly imprisoned in the trap and its head forms an easy and secure target for the hammer or gun. One side of the chamber is made to open outwards, and as soon as the pig is rendered unconscious the side is released; the pig falls out and can be bled forthwith.

In Holland a pig trap is in use which is made of iron, with sloping sides which narrow towards the floor. The bottom of the trap is false, and as soon as the pig is driven into the trap the bottom falls out, and the animal is suspended firmly wedged between the sides of the trap, where it can be stunned or shot without fear of struggling. Immediately the blow is struck, the pig can be tilted on to the ground by means of a moveable side of the trap, and bleeding can be undertaken without loss of

time. Felling pens are now being used in this country with success, both for pigs and cattle.

BARRETT-SMITH PIG TRAP.—This trap is of British make and although resembling other pig traps in its general mode of operation, it differs from them in that when stunned the pig is " delivered from below, thus avoiding the risk of bruised or broken legs ". The pig is driven up a sloping gangway and enters the back of the trap. As soon as he is in a convenient position for stunning, a lever is pulled which slides the floor from beneath the pig's feet. The animal then falls and his body is held

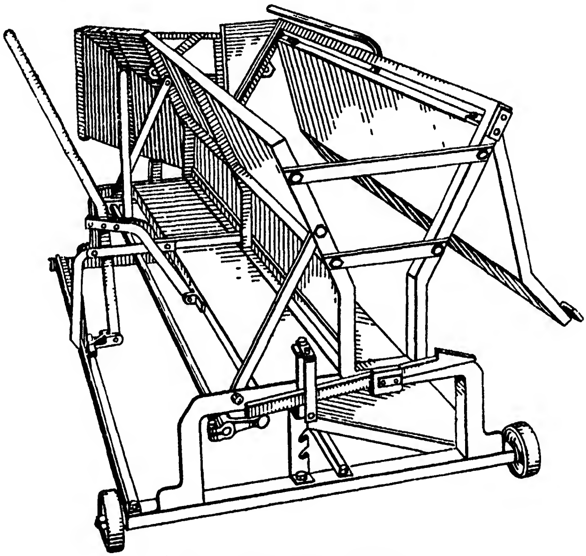


Fig 5 — Barrett-Smith Pig Trap

firmly by the sloping sides of the trap when stunning is effected. A second lever is then pulled which opens the side of the trap and allows the pig to slide by its own weight down the slope of the base plate on to the slaughter-house floor. The base is adjustable and can be put at what is found to be the most convenient angle.

Casting Pen.

A casting pen designed by Mr. H. Weinberg has been recommended by the Shechita Committee for use in the Jewish slaughter of beasts. The pen is constructed so that it closely resembles the ordinary cattle stall; it is thickly padded and adjustable to any size of beast. By means of two large rings which revolve within the pen, it is made to rotate so that the animal is gently turned till it comes to rest upon its back on the padded top of the pen. The head lies on a low platform in a position which facilitates cutting of the throat.

Use of this device obviates casting the animal, which is often attended with difficulty and much unnecessary suffering to the beast.

The Lairages.

As already stated, there should be one lairage for cattle and sheep, and another in a separate building for pigs. An open passage generally intervenes between the building containing the lairage for cattle and sheep and the adjoining slaughter-hall. This serves to disconnect aerially the one building from the other and prevents the passage of odours from the lairage into the slaughter-hall. Owing to difficulties attending the driving of pigs, the passage is sometimes omitted in the block provided for those animals.

If the abattoir is adjacent to the cattle market, the driving of animals from one to the other may be facilitated by the provision of suitable connecting stockways which can be operated under supervision. Care should be exercised in the design and layout of passages, pens, and gates, particularly in regard to the approaches to the lairages and to the pens, widths of doorways and passages, and capacity of pens for each class of stock. The rough handling to which cattle were subjected in the past may, to a large extent, be eliminated by the introduction of a collecting or sorting pen from which animals may be passed into any desired waiting pen, and from thence to the stunning pens.

The pens should be of strong construction, woodwork being entirely eliminated. Reinforced concrete divisions are sometimes used, with iron gates, but in the resting pens for cattle and sheep the use of wrought-iron tubes in horizontal lines, suitably spaced, and passing through cast-iron posts, is preferred by some experts. The gates should be hung so as to enable them to swing from either end, thus they may be used to close the pen or to act as a barrier across the passage.

Each cattle pen and stall should be provided with galvanized-iron drinking bowls of the gravity supply type, and although animals should not be fed for 24 hours before slaughter, hayracks or feeding troughs should be installed as some of the animals may remain two or three days in the lairs prior to slaughter.

Pennage for pigs may be constructed of reinforced concrete with C.I. channel type posts and steel plate gates, or they may be formed of steel plate panels and cast-iron round posts. Leadless glaze fireclay feed troughs are generally provided in each pig pen.

Slaughter-halls.

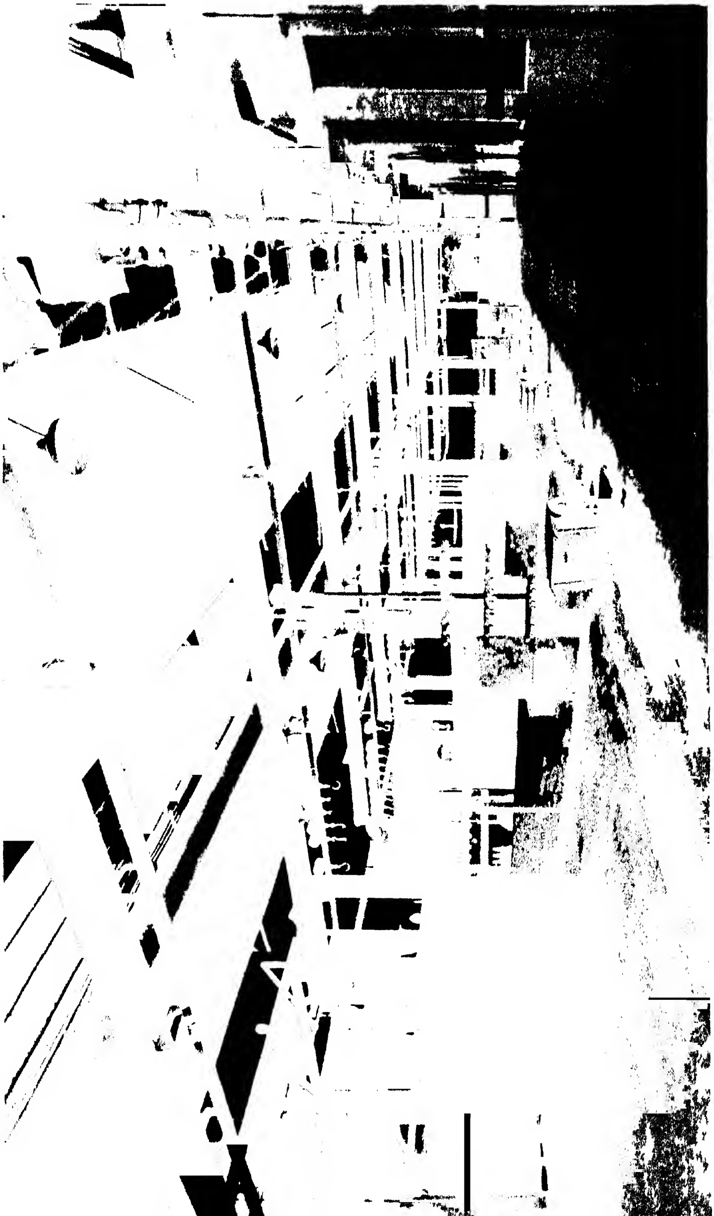
In the past, slaughter-halls were sometimes divided into a number of killing-booths separated the one from the other by a brick wall. This system is now obsolete, the open hall, which facilitates inspection, being generally adopted. In the larger abattoirs, separate departments may be provided for the slaughter of cattle, sheep, and pigs. In the smaller abattoirs, cattle and sheep are slaughtered in one building, and pigs, which have to be scalded in boiling water, in another.

CATTLE SLAUGHTER-HALL.—The position and working of the cattle stunning pens has already been described. The bleeding passage is situated close to the stunning pens, and an electric hoist should be provided in close proximity to each stunning pen to raise the carcass to the bleeding rail from which it is transported and lowered on to the dressing stands. At this point it is usual to provide a " self-sustaining hoist ", which gradually raises the carcass as dressing proceeds. Dressing stands should be placed at a distance of not less than 10 feet apart. Each should be fitted with a galvanized-iron rail provided with appropriate hooks on which the heads and offal may be hung, and with branch overhead runways connected with the main rail, which runs the entire length of the slaughter-hall, and by means of which carcasses are transferred through the covered way direct to the cooling hall. The dressed carcass should leave the hall by one door, another being provided for the removal of hides, manure, &c.

Hot and cold water should be laid on to each dressing stand, and cold-water hydrants provided at convenient points for the purpose of washing the floors, &c.

SHEEP SLAUGHTER-HALL.—Sheep are generally stunned, bled, and partially skinned on crutches, and elaborate equipment is not required in a sheep slaughter-hall. It may be desirable, however, to provide catching pens which effectively screen the live animals from the operations of stunning, bleeding, and dressing. These may be placed in the pennage in close proximity to the door leading from the pennage to the slaughter-hall, or, alternatively, in a similar position inside the slaughter-hall.

PIG SLAUGHTER-HALL.—In the block used for these animals the passage between the lairage and the slaughter-hall may be omitted. At the head of each main gangway in the lairage is placed a sliding door (in the wall between the lairage and the bleeding passage of



KIRKCALDY ABATTOIR

Cattle dressing hall showing N B patent automatic double throw stunning pens sub-division of dressing stations twin bar runways, trolleys and general equipment

the slaughter-hall) which opens into a pig trap placed in the bleeding passage. As soon as the pig is stunned and ejected from the trap it is bled. Having regard to the increasing use of electric lethalers, it appears doubtful whether pig traps will be required in the abattoirs of the future.

In some modern abattoirs the floor of the bleeding passage is sunk to form a receptacle for the blood, which is collected in removable containers placed in the bottom of the pit thus formed. The sunk portion of the floor is covered with sectional metal grates on which the pigs are bled.

After bleeding, the carcasses are raised by quick-acting hoists to runways and conveyed to the scalding tanks, the water in which should be capable of being maintained at a temperature of about 148° F. Scraping tables are generally placed in this part of the slaughter-hall, but machines capable of "de-hairing" a large number of pigs per hour are sometimes also installed in large abattoirs.

Provision should be made for the extraction of steam, and it is usual to separate the scalding hall from the pig dressing hall by a screen wall.

All blood, refuse, offal, &c., should be removed by one door situated at as great a distance as practicable from that by which the carcasses leave the slaughter-hall for the cooling hall.

Cooling Hall.

Most of the cooling halls in connexion with municipal abattoirs in this country consist merely of well-ventilated hanging rooms where meat may remain until required by the butcher. As already stated, this building should be connected with the cattle, sheep, and pig slaughter-halls by means of covered ways. The runways from these halls should come direct into the cooling hall, where hanging rails are provided at a height of some 11 ft. 6 in. from the floor level. Wall rails for "smalls" should also be provided at convenient points.

Many Continental abattoirs are provided with cold stores, where the chilling is effected by refrigerating machinery. This practice is sometimes adopted in Britain, and, particularly in large abattoirs, the provision of a chill room, the temperature of which can be maintained a little above freezing-point, is a great convenience to butchers who wish to store their meat for a few days. Generally, however, cooling is effected in this country by means of adequate ventilation, namely, extractors fixed in the roof with inlets in the

walls about a yard from the floor level. Good cross ventilation is possible with centre pivoted windows arranged in three tiers and provided on each side of the hall. These windows also provide the necessary light, and in number and glass area they must be adequate to secure satisfactory lighting at all points. They should be glazed with blue-tinted, non-actinic glass. Electric light is also necessary and should be adequate for general lighting and inspection purposes. The internal surface of the walls should be lined with glazed-brick or tiles to a height of some 8 feet, and, above this dado, walls of carefully pointed brickwork, which is periodically lime-washed, will be found satisfactory. The roof should be lined internally with asbestos sheeting to equalize the temperature.

The loading dock should, of course, be conveniently situated for the removal of meat, and a weighing apparatus at this point in connexion with the runways is a great convenience.

The Tripery.

The tripery should be well lighted by large windows to enable the workers to see clearly what they are doing. Adequate ventilation is essential to carry away the effluvia to which the work gives rise. The walls should be lined to a suitable height with white tiles or glazed bricks and the floors made of granolithic concrete, with coved angles at walls, and sloped to open channels. The fittings may include a tripe boiler, combined cleansing sinks and scraping slabs, offal rail, &c. Hot and cold water should be laid on to the sinks.

Detention Room.

In all abattoirs a room should be set apart in which the carcasses of animals suspected to be diseased or unwholesome may be carefully examined and the final verdict of the inspector passed upon them. Such rooms should be well lighted and provided with glazed brick dados on the internal surface of the walls so that they may be easily cleaned and disinfected. Suitable means should be adopted to exclude flies, which might otherwise crawl over diseased carcasses and then fly to other parts of the abattoir and thus be the means of spreading infectious material.

Condemned Meat Room.

The general construction of this room is similar to that of the Detention Room.

Manure House.

The construction of this building may vary considerably according to the size of the abattoir. In some German abattoirs the stomach and intestines are conveyed to this house and deposited on the floor. They are then emptied of their contents, and material thus accumulated is dropped through a shoot in the floor into manure carts standing below. It has been stated elsewhere that the contents of paunch or stomach should never be emptied on to the floor of the slaughter-hall. Such a practice results in a disgusting mess which in many cases is only partially cleaned up during dressing of the carcass. This may readily be obviated by the use of apparatus supplied by the North British Lifting and Moving Appliance Co. The paunch is raised on to the lip of the galvanized-iron manure containers, hoisted, and the contents discharged into the container. As each container is filled it is picked up by a universal chassis, transported to manure house, where the container is tipped direct into a large skip, the lip of which is flush with floor. The skip is designed and built to contain a full cartload of manure, and, when filled to capacity, is raised and tipped mechanically through a steel hopper into waiting carts. The operation is controlled by an automatic contractor panel in connexion with three push buttons—" Raise ", " Stop ", and " Lower ". There are also limit switches—" Top " and " Bottom "—which prevent the overwinding of gear in either direction. Apart from the question of cleanliness, the saving of labour effected is great.

Dressing-rooms and Lavatories.

One of the chief aims in building a public abattoir is to ensure that the work carried on therein will be done in a thoroughly clean manner. It is a matter of great importance that the hands, persons, and clothing of those engaged in slaughtering and handling meat should be kept as clean as the nature of the work permits. A dressing-room ought, therefore, to be provided, fitted with lockers where butchers can keep clean overalls. Wash-hand basins supplied with hot and cold water, clean towels, &c., are a necessity, and in large abattoirs baths are sometimes provided. Adequate water closet accommodation is, of course, essential.

Boiler-house.

This building contains the boiler for the provision of steam for the various purposes for which it is required and for the hot-

water supply, &c. It may conveniently be situated near to the pig scalding hall and tripery, where steam is used for the vats and tripe boiler respectively.

Hide Store.

It is often of great convenience to butchers to be able to store their hides at the abattoir. A room is, therefore, generally provided for the purpose, a small charge being made for its use.

Cost.

The cost of a municipal slaughter-house must bear some relationship to the size of the population served by the kill, that is to say, if in a town of 100,000 people the whole of the slaughtering is to be done in the municipal slaughter-house the cost would, necessarily, be higher than it would be if half the number of animals were slaughtered in private slaughter-houses and half in municipal slaughter-houses. Some of the more recently erected abattoirs have been built and equipped at a cost of about 7*s.* per head of the population to be served by the kill.

BY-PRODUCTS

" By-products arising from slaughtering fall into two classes. Some are so valuable that almost all butchers make some effort to dispose of them. The remainder are often not utilized, as the cost of collecting, together with the deterioration in quality (and consequent loss of value) due to improper treatment, often renders their utilization unprofitable. In the first-class fall hides, skins, and fats. In the second such products as blood, guts, bones, glands, and the like."

Fats.—" The three principal products arising from the melting of fat are oleo oil, which is the most valuable, stearine and tallow. The proportion of oleo oil which any given quantity of fat will produce depends upon the treatment it receives. It should be kept clean and it should be melted as soon as possible after slaughter." [1]

Fat and tallow rendering works along with those for the production of oleo fats used in the manufacture of margarine are occasionally associated with abattoirs. The premises where processes of this nature are carried on are placed, as a rule, near the boiler-

[1] *Report of the Committee of the Economic Advisory Council on the Slaughtering of Livestock*, 1933.

house so that the offensive gases produced may pass through the boiler fire and be consumed.

Blood Drying is carried on at some abattoirs, and is a source of considerable profit. The blood, collected in shallow vessels during slaughter, is dried by steam and reduced to powder. This powder is used, either by itself or in combination with molasses, as food meal for animals. Blood is also used as a basis of certain pigments, such as turkey red.

Digestors.—Condemned meat may be disposed of in a digestor. Many different forms of digestor have been devised, but they all work on the same principle. The carcass is placed in a large hermetically closed cylinder; steam under high pressure is admitted; the carcass is cooked and sterilized, the residue being made into bone-meal, meat meal, glue, and inedible tallow.

Glandular Products.—Animal glands are utilized for the manufacture of medicinal preparations, large quantities of which are imported from abroad, either ready for use or in a semi-manufactured condition. The collection of glands from slaughtered animals has not yet been developed to any great extent in this country. Skill is required in the removal of the glands, which should be excised as soon as practicable after slaughter and subjected to suitable treatment without delay. It is only in slaughter-houses in which a large number of animals is slaughtered that the collection of glands on an economical basis is practicable.

The Preparation of Tripe.—The following account of the preparation of tripe is taken from a report by Dr. A. W. J. MacFadden to the Local Government Board:

"When the animal is eviscerated in the slaughter-house the stomach is detached, hung on a hook, and the ragged portions of fat and peritoneum are trimmed off. The third stomach, or manifold, which is generally distended with food, is lopped off at its narrow junction with the paunch and is discarded, and the contents of the other cavities are allowed to escape through a wide slit made in the most dependent part of the viscus. The whole tripe, including the rectum or role, is then rinsed in a tub of water and hung up to drain in the slaughter-house.

"At the end of the day's slaughtering the tripes are collected, and are either removed to the boiler to be converted into dressed tripe for the London retail trade, or are packed in sacks for transit by rail to the tripe-dressers in the north of England—generally Lancashire.

"Those brought to the boiler-house are soused without much delay in hot water for about fifteen minutes; they are then hung on a peg, and the mucous surface is scraped clean with a sharp knife, which removes the brown epithelium, leaving a glistening white fresh surface exposed. They are then rinsed in water and transferred to coppers, where they are boiled for two hours (two and a half hours in winter). After boiling, the peritoneal layer is easily stripped off, and when this is done the tripes are again soaked in cold water until the time approaches for dispatching them, when they are placed on boards to drain, and are then packed in hampers for distribution to the retail shops or distributing centres."

Gut-scraping.—Intestines are technically divided into three parts: the black gut or small intestine; the bung gut or cæcum; and the white gut or large intestine, exclusive of the cæcum, called "middles".

Cattle Gut.—The first stage in the preparation of cattle gut for use as sausage skins, which is known as the "cutting-off" process, is carried out at a table provided with two pegs, around which the gut is wound, and a hook to which the end of the intestine is attached. The process consists of cutting away the adherent fat with a sharp knife, care being taken not to cut the gut itself. The intestine is next transferred to a tub of water, where by the aid of running water it is turned inside out; this is termed the "turning process". Then comes the "sliming" or cleaning process; for this purpose the gut, put into a tub of clean water, is drawn several times between the thumb of the right hand and the edge of a hard piece of wood, by means of which it is thoroughly cleaned. It is then salted and put into barrels with heavy weights on the top. To produce a good article the gut should be treated and salted as soon as the animal heat has gone, and when this is done offensive odours are comparatively slight.

Sheep Gut.—The manufacture of sheep gut into sausage casings is a much more offensive process, because the gut is often in a state of semiputrefaction before the scraping commences.

The intestines are in the first place emptied of their contents; they are then put into a tub of water and allowed to stand till putrefaction is well advanced, thereafter they are transferred to a fresh tub of water. After remaining in it for some time they are removed and spread on a cleansing board, where they are scraped with a hard piece of wood or metal scraper. They are next put into pickle, where they remain for a day or two. By this means all smell is effectu-

ally removed from the gut. They are finally measured into bunches of a certain size, put into salt for a time, after which they are ready for use.

APPENDIX A

Utilization of the Carcass

Portion of Carcass	Animal	Purpose for which utilized
Muscles.	All.	Flesh—butcher's joints.
Bone.	All.	Soup and beef extracts. Gelatin from the head bones. Knife handles from long limb bones. Bone meal from small bones. Manure from all bones.
Fat.	Cattle.	Suet from kidney fat. Dripping from omentum fat. Oleo oil.
	Pig.	Lard from leaf and back fat.
	All.	Candles. Tallow. Grease. Soap. Glycerine.
Head.	All.	Meat as brawn. Bones as gelatin.
Feet.	Ox Heels.	Food, eaten freshly cooked. Jelly, made into invalid jelly. Oil, as Neat's Foot Oil.
	Sheep.	Food as sheep's trotters (cooked).
	Pig.	Food as pig's feet (cooked).
Hoofs.	All.	Glue. Manure. Prussian Blue dye.
Horns.	All.	Knife handles. Spoons. Buttons. Hairpins. Gelatin.
Hides.	All.	Leather.
Tail.	Ox.	Soup and stews.
Hair.	All.	Hair brushes. Mattresses from tail hairs. Upholstery. Paint brushes from ear hairs. Felt. Plaster. Wool (sheep).
Brains.	All.	Food.
Cheeks.	All.	Food.
Tongue.	Ox and Sheep.	Food—fresh, pickled, and in brawn.
Thymus Gland.	Calf.	Food as " sweet bread ". Medicinal Extract.
Lungs.	All.	Cat's meat.
Heart.	All.	Food, fresh and in sausages.
Blood.	All.	Food in black puddings. Albumen. Sugar refiner. Cattle foods. Fertilizer.
Œsophagus.	Ox Weasand.	Outer covering—for sausages. Lining—sausage casings.
Stomach.	Ox.	Food as tripe.
	Sheep.	Food container as haggis bag. Dog's meat and poultry food.
	Calf.	Rennet.

UTILIZATION OF THE CARCASS—*continued*

Portion of Carcass	Animal	Purpose for which utilized
Stomach—*contd.*	Pig.	Food as tripe and chitterlings. Pepsin.
Small Intestines.	Ox Runners.	Food casings for black and white puddings and saveloys.
	Sheep.	Sausage casings (small size for chippalata). Violin strings. Cat-gut for surgical sutures.
	Pig.	Food casings for pork and beef sausages.
Large Intestines.	Ox Colon (middles).	Large food containers.
	Ox Bung (cæcum).	Outer covering for gold-beater's leaf.
	Sheep Colon.	Casings for Paris and veal sausage.
	Sheep Bung.	Casings for hazelets.
	Pig Colon.	Food as chitterlings.
	Pig Bung.	Food as chitterlings.
Liver.	All.	Food, cooked and raw. Extracted for medicinal purposes.
Gall.	All.	Extract used medicinally. Cleaning agent. In carpet soap. For sepia pigment.
Spleen.	Sheep.	Extracted for medicinal purposes.
Kidney.	All.	Food.
Omentum Mesentery.	All.	Dripping and suet (oleo).
Skirt.	All.	Food.
Udder.	Cow.	Food.
Bladder.	All.	Lard container. Floats for fishing nets.
Testes.	Lamb.	Food as " lamb fries ".
Trimmings.	All.	Sausage meat from the best parts. Glue from the remainder and manure.

MEDICINAL EXTRACTS

Organ	Preparation
Pancreas	Insulin (in Diabetes).
Thyroid	Thyroid Extract (in Thyroid diseases).
Spleen	Splenic Extract (in anæmias).
Supra-renal	Adrenalin.
Thymus	Antirachitic Extract.
Pituitary	Pituitrin.
Udder and Sex Glands of Cow and Sheep	Hormotone, &c.
Testes and Male Glands	Extracts for Male Disorders.
Gall	Extract for Intestinal Disorders.

APPENDIX B

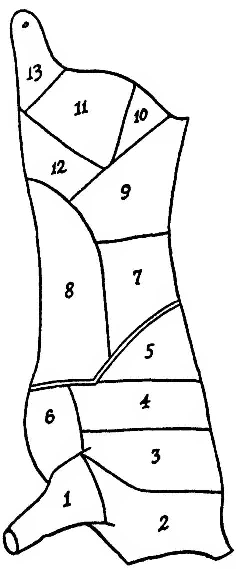
BUTCHER'S JOINTS

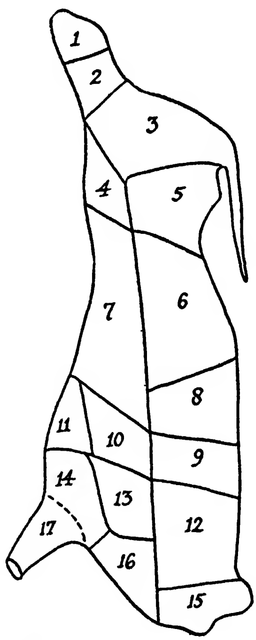
Carcasses are cut into joints, but as these differ considerably in different places, the chief London joints are described and illustrations of other " cuts " are appended.

London Beef Joints.

Each side of the carcass is quartered or divided into fore- and hind-quarters.

With the side of beef hanging from the leg, the vertebræ are sawn through between the 7th and 8th vertebræ, counting downwards from the top section of the lumbar vertebræ. A cut is then made in a curve from the vertebræ untii the 6th rib is reached, and from there the cut is continued straight across to the brisket, which is sawn through. The carcass is thus divided into " fore " and " hind " quarters. The cuts marked 1 to 6 in Fig. 1 below form the joints of the fore-quarter, and the remainder those of the hind-quarter.





Scotch Cuts of Beef

1. Hind knuckle.
2. Fleshy hough.
3. Round steak.
4. Thick flank.
5. Heugh bone or Pope's-eye.
6. Sirloin roast.
7. Flank.
8. Rib end of sirloin.
9. Rib roast.
10. Thin runner.
11. Nine holes.
12. Shoulder.
13. Thick runner.
14. Brisket.
15. Neck.
16. Thick brisket.
17. Fore hough.

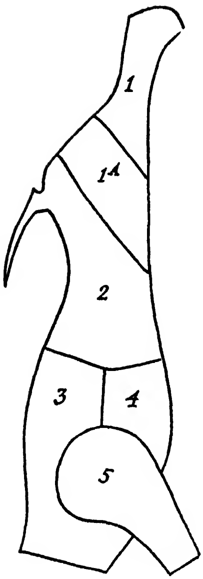
Beef Cuts

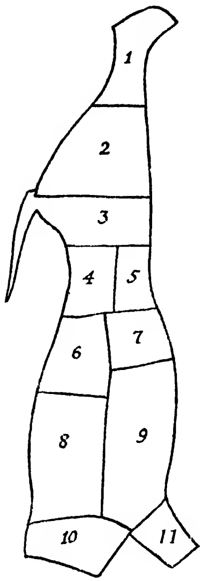
Fig. 1—London Cuts

Fig. 2.—Scotch Cuts

London Cuts

No.	Joint Name	Average Weight	Bones Contained	Important Glands Contained
1.	Shin.	8 lb.	Radius, ulna.	Nil.
2.	Clod and sticking.	25 lb.	Humerus, several cervical vertebræ.	Prescapular, cervical.
3.	Back ribs.	30 lb.	Dorsal vertebræ, two ribs, narrow end of scapula.	Axillary and first two intercostals.
4.	Middle ribs.	32 lb.	Dorsal vertebræ, 3, 4, 5, 6; four ribs; broad end of scapula.	Four intercostals.
5.	Fore-ribs.	20 lb.	Six dorsal vertebræ, posterior six ribs, small piece of scapula.	Intercostals.
6.	Brisket.	20 lb.	Sternum, portions of six ribs.	Presternal suprasternal.
7.	Sirloin.	35 lb.	Six lumbar vertebræ, one dorsal vertebra, one rib, part of the ilium.	Renal, part of iliac, sub-lumbars, psoas.
8.	Thin flank.	15 lb.	Portions of ribs.	Part of precrural.
9.	Rump.	30 lb.	Sacral vertebræ, part of Pelvic bone.	Portions of iliac, ischiatic and precrural.
10.	Aitch bone.	10 lb.	Head of femur, part of ischium and body of pelvic bone.	Part of the ischiatic.
11.	Round (top side and silver side).	40 lb.	Pubic end of pelvic bone, shaft of femur.	Popliteal.
12.	Thick flank.	16 lb.	Patella (part of femur and pubic bone sometimes).	Part precrural superficial inguinal or mammary.
13.	Leg.	14 lb.	Tibia and fibula.	Nil.





Scotch Cuts

1. Hind knuckle.
2. Fillet or gigot.
3. Chump.
4. Flank loin.
5, 7. Flank.
6. Rib loin.
8. Shoulder.
9. Breast.
10. Neck.
11. Fore knuckle.

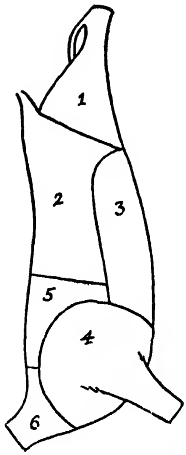
Veal Joints

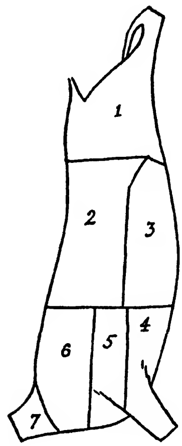
Fig. 3.—London Cuts

Fig. 4.—Scotch Cuts

London Cuts

No.	Joint Name	Average Weight	Bones Contained	Important Glands Contained
1.	Leg knuckle and IA fillet.	10 to 12 lb.	Femur, tibia, fibula.	Popliteal, precrural, superficial, inguinal or mammary.
2.	Loin.	11 lb.	Pelvic bones, sacral, lumbar, last two dorsal vertebræ, 2 ribs.	Iliac, renal sublumbars.
3.	Neck.	4 to 5 lb.	Dorsal vertebræ, cervical vertebræ; part of 11 or 12 ribs.	Intercostals.
4.	Breast.	3 to 4 lb.	Sternum and tops of ribs.	Presternal, suprasternal.
5.	Shoulder.	9 lb.	Scapula, humerus, radius, ulna.	Prescapular.





Scotch Cuts

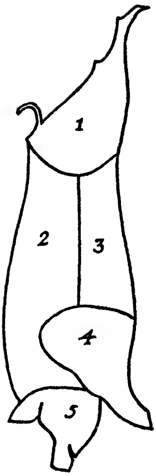
1. Gigot or leg.
2. Loin.
3. Flank.
4. Fore shank.
5. Runner.
6. Shoulder.
7. Neck.

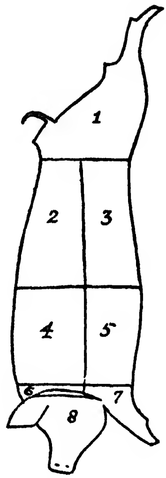
Mutton Joints

Fig. 5.—London Cuts Fig. 6.—Scotch Cuts

London Cuts

No.	Joint Name	Average Weight	Bones Contained	Important Glands Contained
1.	Leg.	7 to 8 lb.	Tibia, femur, patella, part of pelvic bone.	Popliteal, part precrural, S. inguinal or mammary.
2.	Loin.	7 to 8 lb.	Sacral, lumbar, last two dorsal vertebræ, two ribs, part ilium.	Iliac, renal sublumbars, part precrural.
3.	Breast and flank.	3 to 4 lb.	Sternum and tops of ribs.	Presternal, suprasternal.
4.	Shoulder.	7 to 8 lb.	Scapula, humerus, radius, ulna.	Prescapular.
5.	Best end of neck.	4 to 5 lb.	Dorsal vertebræ, 11 or 12 ribs.	Subdorsals.
6.	Scragg end of neck.	2 to 3 lb.	Cervical vertebræ.	Cervicals.





Scotch Cuts

1. Leg.
2. Loin.
3. Belly.
4. Back rib.
5. Breast.
6. Fore knuckle.
7. Neck.
8. Head.

Pork Joints

Fig. 7.—London Cuts Fig. 8.—Scotch Cuts

London Cuts

No.	Joint Name	Average Weight	Bones Contained	Important Glands Contained
1.	Leg.	8 to 9 lb.	Tibia, fibula, femur, patella, most of the pelvic bone.	Part of precrural, popliteal, hock, S. inguinal or mammary.
2.	Loin.	24 to 28 lb.	Ilium, sacral, lumbar, and last two dorsal vertebræ, parts of ribs.	Iliac, sub-lumbars, renal, subdorsals.
3.	Belly.	4 lb.	Tops of ribs and several joints of the sternum.	Part of precrural.
4.	Hand and spring.	7 to 8 lb.	Scapula, humerus, radius, ulna.	Suprasternal, prepectoral, part of submaxillary.
5.	Head.	8 to 9 lb.	All head bones.	Parotid, retropharyngeal part of submaxillary.

Section V.—Fish, Poultry, Eggs, Cereals, Beverages, and Condiments

CHAPTER I

Fish

Fish: Classification—Freshness—Signs of Staleness—Inspection—Diseases: *Filaria bicolor*—*Bothriocephalus latus*—*Echinorynchus*—Salmon Disease—Tumours.
Shellfish: Oysters — Mussels — Escallops — Cockles — Winkles — Whelks—Crabs—Lobsters—Crayfish—Shrimps.
Outbreaks of disease in connexion with shellfish.
Methods of Preserving Fish: Ice—Brine—Smoking—Canning—Fish pastes—Fish oils.

The consumption of fish in this country has reached large proportions; it is therefore of great importance that the food inspector should be able to recognize the different fishes used for food, as well as to judge of their quality. As a result of improved methods of preservation and transport a large variety of fish now reach our markets.

Fish breathe by means of gills, and have fins instead of limbs for progression. By the number and position of the fins the different fishes may be recognized. A diagram on p. 240 serves to indicate the names and positions of the fins.

Fish vary greatly in form, shape, and size, also in feeding and habitat, some living near the surface of the water where they feed on minute forms of life, while others feed on fish found only in deep waters at the bottom of the sea.

Fish are sometimes divided into *white fleshed*—including cod, brill, flounders, plaice, sole, turbot, whiting, &c.; *red fleshed*, such as salmon and sea-trout; *greasy fleshed*—including herring, mackerel, pilchard, eels, sprats, &c.; and *shellfish*—crabs, lobsters, oysters, cockles, mussels, &c. But for the purpose of classification they may more easily be divided into:

Flat fish, which live near the bottom of the sea, and round or swimming fish, which live, for the most part, nearer to the surface.

The fins of fishes are paired or unpaired. There are two paired fins: the pectoral on the sides of the fish immediately behind the gills, and the pelvic on the belly. The unpaired fins are three in number:

the dorsal, which runs along the back of the fish, the caudal fin (commonly called the tail), and the anal fins, below the fish and near to the tail. A series of specially modified scales running along the sides of many fishes constitute the so-called " lateral line ", while a barbel or small appendage is sometimes attached to the lower or upper jaw.

Flat fish are characterized by the unsymmetrical conformation of the head and anterior regions of the body, in consequence of which both eyes are brought on to one side of the body—in some cases the right and in others the left. The body is compressed and

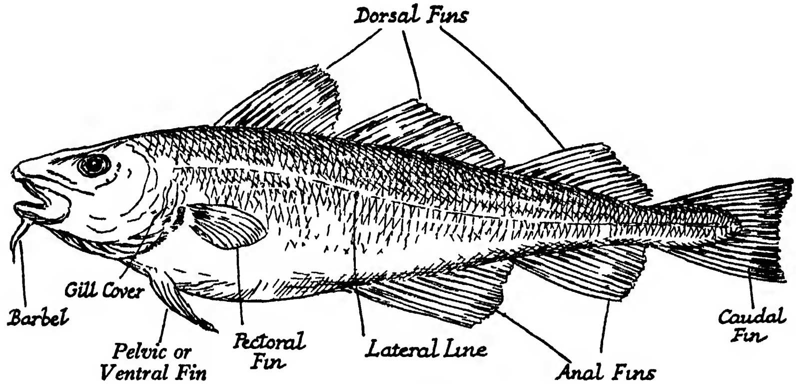


Fig 1 —Cod

flattened. The side which is turned upwards when the fish is in the natural position in the water and on which the eyes are situated is generally dark in colour, while the opposite or eyeless side is usually colourless. Some flat fish have a greater development of the teeth on one side of the jaw than on the other.

For convenience of description and to assist in identification the different kinds of fish may be grouped as follows:

ROUND FISH

The **Cod Family** may be divided into two groups in accordance with the number of dorsal fins possessed by the various members.

Group I with three dorsal fins.

(*a*) The Cod is of a greenish or brownish olive colour with a number of yellowish or brown spots and a white lateral line. It generally has a single barbel dependent from the chin. (Northern Seas.[1])

[1] The habitat of fish appears in brackets.

(*b*) The HADDOCK may be recognized by the blackish patch on each side of the body above the pectoral fin—so called "finger and thumb marks"—and by the black lateral line. It is of a uniform grey or bronze colour with a white belly. It has a small barbel. (North Sea.)

(*c*) The WHITING is of a uniform greenish yellow colour above, and white below. There is no barbel in the adult fish, but there is a small black spot near the root of the pectoral fin. The whiting is lighter in colour than the haddock, the lateral line is not so distinct, and it possesses neither a blackish patch not barbel. (British Isles.)

(*d*) The COALFISH or SAITHE or ROCK SALMON is dark blue or black in colour on the back, with a white lateral line and whitish belly. It is larger than a whiting. (British Isles, Shetland.)

(*e*) The POLLARD or LYTHE is olive green in colour, with a curved and well-marked lateral line. The lower jaw protrudes and has no barbel. (British Isles.)

(*f*) The BIB or POUT WHITING is of a dark bronze colour with dark bands down the sides. It is possessed of considerable depth in proportion to its length, and has a large barbel on the chin.

Group II with two dorsal fins.

(*a*) The HAKE somewhat resembles a ling in shape. It is of a dark grey colour above, shading off to a dull silvery-grey on the belly. The top of the head is flat, the jaws are long, and there are two rows of sharp teeth. The inside of the mouth is dark in colour, the scales are large. (West and south coast England and Mediterranean.)

(*b*) The LING may easily be mistaken for the conger eel, but it may be distinguished by the fact that the dorsal fin is broken near the tail, whereas in the conger it is continuous. The skin is smooth and there is no barbel. The colour is generally dull yellowish grey. The scales are small. (Europe, Iceland, and Greenland.)

HERRING FAMILY

This family is characterized by the silvery colour and absence of the lateral line.

(*a*) The HERRING is so well known that little need be said in regard to it. The dorsal fin commences half-way between the tip of the nose and the commencement of the tail. (British Isles, North Atlantic, Northern Asia.)

(*b*) The SPRAT seldom exceeds 6 inches in length. It very much resembles a young herring, but its scales are larger than those of a herring of the same size, and the edge of the belly is serrated, whereas that of the herring is smooth. The dorsal fin of the sprat commences nearer the tail than in the case of the herring. (England, south and east coasts.)

(*c*) The Pilchard or Sardine is very similar to the herring in appearance. It has larger scales, a more rounded body, and a deeper green colour. When held by the dorsal fin the fish will balance itself. (English Channel and Mediterranean.)

(*d*) Whitebait generally consist of young herring or sprats, and are readily recognized by their bright silvery colour and small size. (England.)

(*e*) The Anchovy is a small fish with a projecting snout. It is of a green colour with a broad silver band on the sides and a deeply forked tail. (Mediterranean.)

THE SALMON FAMILY

(*a*) The Salmon is a long round fish, of bluish black colour on the back, shading into white on the belly. It should be plump and clean looking, with bright silvery scales and firm red flesh. The salmon periodically leaves the sea and ascends rivers for the purpose of spawning. The female fish deposits her eggs on the gravel forming the bed of the river, and they are fertilized by the male fish covering them with milt. The young salmon when hatched are known as " alvin ", and after two years as " parr ", which name they retain until they lose their trout-like appearance and visit the sea as " smolts ". After remaining in the sea for a considerable time they ascend the river as " grilse ", which is the name generally given to a salmon that has never spawned. After spawning they return to the sea often in a very exhausted condition, the term " kelts " being applied to such fish. Kelts should never be used, as they are unclean and unseasonable. (British Isles, Norway, Canada, France, and Holland.)

(*b*) Salmon Trout are much smaller than salmon, and stouter, especially towards the tail. The scales are smaller than those of the salmon, the colouring is much the same, but the trout is pink along the cheek and sides and spotted on the gill cover. (British Isles, Norway, &c.)

(*c*) Common Trout are most easily distinguished by dark spots along the sides and red spots on either side of the lateral line. The back is brown either of a yellow or red shade. The scales are small. (Rivers of the British Isles.)

(*d*) Grayling is a slender fish with curved back; the upper jaw is longer than the under. The back is golden yellow, the sides lined with parallel grey lines; the fins have purple spots and are banded. (English and Northern European Rivers.)

(*e*) The Smelt or Sparling is of a light shade of olive green with silvery sides and belly. It measures from 6 to 8 inches in length. The odour of the fish when fresh is supposed to resemble that of cucumber. The smelt must always be used when fresh, as it is very perishable. (British Isles, Holland.)

EELS

The EEL is of a dark olive colour on the back and possesses small scales. The lower jaw is longer than the upper, and the dorsal fin commences at a considerable distance from the head. (British Isles, Holland, Denmark.)

The CONGER EEL is of a dark grey or almost black colour. The lower jaw is shorter than the upper. The dorsal fin commences near the head and no scales are present. (The British and European Seas.)

The GREATER SAND EEL has a silvery white colour on the belly. The lower jaw is longer than the upper and is grooved like a trowel. The tail fin is deeply forked.

The LESSER SAND EEL is brown in colour. The lower jaw projects, but is shallow and pointed and not grooved.

The following round fish do not conform to any particular type, and are therefore described separately:

The BASS is a very handsome fish, greenish brown in colour with silvery scales. The first dorsal fin is like that of the perch. (British Isles, European river mouths.)

The SKATE.—Several varieties of the " ray " family are included under the general name of skate. The common skate is of a pale grey colour with black spots, and may readily be recognized by its characteristic diamond shape and long narrow tail. The " roker ", which is a variety of short-snouted skate, is usually sent to market cut into " wings " (as the rest of the fish is of little use for food), and these are often very thorny on the dark side. (Round the British coast.)

The MACKEREL is well known and requires no description. It spoils rapidly and must be obtained as fresh as possible. (British coast.)

The GURNARD has a large head in comparison with the size of its body and is distinguished by sharp spines on the dorsal fins, and sometimes also on the lateral line and on the base of the pectoral fin. (British coast, North Sea.)

The GREY MULLET is round in shape and silver grey in colour, with dark markings along the sides. The tail fin is deeply forked, and there are two short dorsal fins. (West Ireland.)

The RED MULLET is a small silvery red fish with longitudinal yellow bands, large almost transparent scales, and two barbels on the lower lip. Its teeth are small and blunt. It is generally cooked undrawn or with the trail left in, and is highly prized as an article of diet. (English south coast.)

FLAT FISH

Group I with equal development of teeth on both sides of the jaw, and eyes on the right side.

(*a*) The Halibut is a large fish. It is generally of a very dark dusky brown or olive colour on the one side, the other side being white and smooth. It is characterized by the eyes being on the right side, and the teeth on both sides of the jaw being equal. (British east coast, Northern Seas.)

(*b*) The Long Rough Dab resembles the halibut but is less in size. It is very rough to the touch and of a lighter colour than the halibut.

Group II with greater development of the teeth on the lower side of the jaw, and eyes on the right side.

(*a*) The Plaice is dark brown on the upper side with orange spots. The mouth is small with broad blunt teeth, which are larger on the lower side. The lateral line is nearly straight. (British Isles, Iceland.)

(*b*) The Dab resembles the plaice, but is much rougher to the touch owing to its spiny scales. The lateral line curves abruptly over the pectoral fin. (British Isles.)

(*c*) The Flounder or Fluke also resembles the plaice but has no orange spots. It is of a very dark colour above and bright white below. It has spines along the edge of the fins and along the lateral line. (Estuaries of the British Isles.)

(*d*) The Lemon Dab (known in the trade as Lemon Sole) is of a rich brownish yellow colour mottled with dark and light spots. It has a small head and mouth. (British Isles, Iceland.)

(*e*) The Witch or Pole Dab closely resembles the lemon dab. The body is oval and elongated. The eyes are large, but the head and mouth are small. It is pale brown in colour over the upper side, while the lower side is of an opaque white shade. (British Isles, west coast, and North Sea.)

Group III with equal development of teeth on both sides and eyes on the left side.

(*a*) The Turbot is characterized by the absence of scales, their place being taken by worty tubercles on the back. It is of a brown colour on one side. (British Isles, Mediterranean.)

(*b*) The Brill has a perfectly smooth skin and is similar in colour to the turbot, but is more oblong in shape. (British Isles, North Sea, Mediterranean.)

(*c*) The Megrim or Sail-fluke is light brown in colour without distinctive markings; it is similar in colour to the witch. The head, mouth, and eyes are relatively large. (Norway, North Sea.)

The Common Sole has teeth only on the lower jaw, and eyes on the right side. The upper side is brown in colour with dark markings, the back is rough. The mouth is curved. (British Isles, Irish coast, North Sea.)

Freshness of Fish.—There are great differences in the keeping qualities of fish, some go bad much more rapidly than others. Surface fish, such as mackerel and herring, should be eaten as soon after being caught as possible, as their flesh deteriorates rapidly. Cod, whiting, and haddock keep longer, especially if stored in a cool place. Flat fish, or bottom fish, like plaice, sole, turbot, &c., keep best—indeed, it is said that the last mentioned is improved by being kept a day or two.

The freshness of a fish on arrival at the market partly depends on the manner in which it has been caught, handled, packed, and transported, and also on the relation to its spawning season. Fish caught by line are generally in better condition than those taken in nets, particularly trawl nets. Roughly handled or carelessly packed fish decompose rapidly, as do improperly gutted, or "foul gutted" fish, in which portions of liver and intestine have been left. Fish should be gutted as soon as practicable after being caught. Some Norwegian fishermen not merely gut but also bleed fish by making an incision below and behind the gills or above the tail, and it is said that fish thus treated keep better.

Careless packing is a frequent source of stale and decomposing fish. All boxes, barrels, &c., employed for the purpose should be carefully cleansed before use, and the fish should be tightly and carefully packed. Insufficient brine or ice in packing leads to early decomposition, and those packing fish should use sufficient material to attain the object of its use, namely, the preservation of the fish.

It is important that fish should be in season. They are in the best condition just before spawning, thereafter they become poor, thin, and their flesh is watery and less firm. For a short time after spawning they remain in poor condition, and should be given opportunity to recover before being fished.

(A table of the spawning seasons of fish appears on p. 258.)

Signs of a Fresh Fish.—A fresh fish is firm to the touch, solid, and opaque, and neither semi-gelatinous nor watery. Its flesh adheres firmly to the bones, and its scales (which should be intact) and gills are bright. Cases are on record where the gills of stale fish were artificially coloured with fresh bullock's blood in order to give the fish the appearance of being fresh. The abdominal

cavity should be clean, and the flesh firm and not discoloured on the sides. In flat fish the skin should be smooth, moist, and closely adherent to the flesh; it is a bad sign if the skin be blistered. A fish in thoroughly good condition ought to be broad across the back, large girth rather than great length being desirable. Round fish when fresh are perfect in shape, round and firm; if in poor condition or stale they become more triangular and their flesh is flabby when cut.

Signs of Staleness.—Stale fish are flabby and soft, and possess sunken eyes, discoloured gills, and a disagreeable odour. Smell alone is not, however, a sure guide, because fish that have been kept on ice may have no smell and yet change very rapidly when removed from the ice. The abdominal walls become soft, red, and pulpy looking, and may show discolouration when decomposition has set in.

The flesh of a stale fish pits easily on pressure from the finger, and can be readily separated from the bone, leaving a discolouration on those parts of the flesh which have been in contact with the bony structures.

Fish as an Article of Diet.—The white-fleshed fish are nutritious and easily digested. Salmon and greasy fleshed fish are more difficult to digest. There have been a number of cases of " mackerel poisoning ", due, in some instances, to the fish being out of season, but more frequently to their having been kept too long. Some persons have an idiosyncrasy to herring and mackerel, and become ill after eating them, even though they are perfectly fresh and in good condition. The symptoms are generally vomiting, purging, great prostration, accompanied sometimes by urticaria. Certain fish found in tropical waters seem to be poisonous, especially at the breeding season.

INSPECTION OF FISH

As in all inspections, the inspector should follow a definite routine. He should begin with a general survey of the fish exposed for sale in the stall, shop, or market, thereafter he should sample the fish by handling, and if not satisfied should then proceed to open and examine the suspected fish. In the general scrutiny, the condition of the eyes, scales, and shape of the fish will be observed. There are special points to be noted in certain fish, e.g. mackerel

show a beautiful rainbow colouring when fresh which is absent when they are stale. While examining the gills the fish should be felt, to ascertain if it is firm and elastic, and the inspector should pinch the flesh between his fingers, in order to judge of the elasticity. If a fresh sprat be pinched it will spring from the grasp and may be shot some distance, while if stale it can easily be retained between the fingers.

If the inspection and handling have given rise to doubt as to freshness, the inspector should proceed to split the fish and examine the backbone for signs of decomposition. In commencing decomposition the bone appears pink from the end of the tail upwards, and such fish should be condemned. In round fish the " sound " or strong membrane, forming a bladder in front of the backbone, should be torn down, and the condition of the backbone be ascertained. If there is no " taint " on the finger after it has been inserted into the bone and blood, the inspector may pass a fish which had been " suspect " from the condition of the eyes and gills.

In flat fish the " vent ", or abdominal cavity, shows discolouration when the fish is stale; the inspector should therefore split the suspected fish down the lateral line and examine the bone for taint.

Fish are generally condemned on account of decay or putridity and very seldom on account of disease or parasites, although they are peculiarly liable to the latter. It is therefore important that the inspector should be able to recognize decay in fish, and in this connexion he cannot do better than follow the advice given by Dr. Anderson, in an official report, who considers that the following tests are fairly reliable in the detection of decomposition:

1. When *rigor mortis* has passed off.

2. When there is a reddish discolouration along the backbone.

3. When the smell is becoming tainted and passing on to the putrid stage.

4. When the flesh strips rapidly and cleanly from the backbone.

5. When the abdominal walls have a soft, pulpy, and jelly-like appearance, with commencing discolouration and tainted odour.

6. When the gills have lost their characteristic tint, and are becoming grey and slimy.

7. When the eyes are grey and sunken.

When these conditions are present, undoubtedly the fish can and should be condemned.

DISEASES OF FISH

Fish are subject to many diseases, but are said to be more healthy than animals which live on land, and it is asserted that few of the diseases to which they are subject are communicable to man. Fish may be infested with many parasites; they are attacked by tapeworms, thread-worms, crustaceans, and fungi, but only a few of these conditions need be touched upon in a book of this nature.

Filaria bicolor.—A worm of the Nematode group, but in appearance like a thread-worm, is 1½ inches long and is found in codfish. There may be no external signs of the presence of the worm even though the parasite is present in large numbers in the flesh of the fish. No known illness results in man from eating fish infected with this parasite, and it is thought that the temperature of cooking destroys the worm. Infected fish are, however, unpleasant in appearance, and would not find an easy market if the condition were discovered.

Worm infection is met with in haddocks and saithe as well as in cod.

Bothriocephalus latus.—This tapeworm can be conveyed to man through infected fish which have been insufficiently cooked. The cysts of the immature worm are found in cod, turbot, and pike principally, and can be readily recognized as white bodies in the flesh which is less white than the cysts, the surrounding tissues having a transparent appearance in comparison with the dead white of the cysts. The life-history of the worm is said to be identical with that of *Tænia solium* of the pig. (See p. 132.)

Echinorynchus.—A thread-like tapeworm of one inch in length found in the trout. The proboscis of the worm is provided with hooks which cause serious inflammation.

Salmon Disease.—Fish of the salmon species—salmon, sea-trout, trout, &c.—are attacked by the bacillus *Salmonis pestis*, which causes white patches on the head and near the tail. The patches spread, and when the salmon enters fresh water, the spores of a fungus which lives on dead tissue settle in the patches and grow. This fungus is known as *Sapriolegnia ferax*. The disease spreads from fish to fish and infection takes place through skin abrasions. The condition was formerly thought to be due to a fungus, but it has been shown to be produced by invasion of the tissues by the bacillus *Salmonis pestis*, and the secondary infection is merely a surface infection by the fungus which thrives on the dead tissues of the fish.

Furunculosis.—A boil-like disease seen in salmon trout and some of the fresh-water fish. The cause of the condition has not yet been determined. Nodules form under the skin of the fish, gradually enlarge, and finally burst and discharge fluid matter. By experiment it has been

found that if fluid from the boils is injected into apparently healthy fish they die in from five to eight days.

Cancer.—Growths resembling cancer are said to occur in fish and are most often seen as nodules on the lower jaw and gill rays, but may spread and affect all the structures of the head and neck.

Tumours of various sizes are not uncommon around the head and neck in some fresh-water fish; they are of the nature of cysts and as a rule contain myxosporidial micro-organisms (according to Prof. Matthew Hay of Aberdeen). Large tumours are occasionally found in halibut, cod, cat-fish, &c., but these are of a fatty-fibrous nature.

SHELLFISH

There are two main classes of shellfish, the molluscs and the crustaceans, the former having soft bodies partially or wholly protected by a shell, and the latter having their entire bodies encased within hard shells. The molluscs commonly used for food are oysters, mussels, whelks, cockles, escallops, and winkles; the main crustaceans eaten being lobsters, crabs, crayfish, prawns, and shrimps.

Molluscs.

The Oyster is a bivalve, and consists of a creamy white body contained between two hard ovoid shells, which are held closely together by a strong adductor muscle. The habitat of this shellfish is in salt water, generally in estuaries, or on sandy beds, or on rocks near the shores. They are obtained from the British Isles, Holland, Portugal, and America. English or "native" oysters are those obtained from districts where the London clay forms the soil of the river beds; they are smaller than the varieties obtained from Holland, Portugal, and America.

Oysters take several years to mature and "natives" are considered best at from four to six years of age. When dredged the immature shellfish are bedded out in special beds according to their size and are gathered for market when known to have reached maturity. Disease is rare in oysters, but these shellfish are liable to contamination, or pollution, from impure sea-water or foul beds; they can, however, cleanse themselves when transferred to clean sea-water for a period of from 10 to 14 days.

Open season: English "natives" are in season from 4th August to 14th May; those from deep sea up to 14th June, while foreign oysters may be sold throughout the year.

Inspection: Fresh oysters have tightly closed shells; if open, shells should close immediately on being touched, but even a slight opening of the shell indicates loss of freshness. Oysters with gaping shells are moribund or dead and are unfit for food.

Mussels are bivalves averaging from 2½ to 3 inches; the soft red or yellowish red body is held between two elongated oval shells of a beautiful blue-black colour on the outside and a glistening white interior. These shellfish are plentiful around Great Britain and are also obtained from Holland. They are found at sea bottom and in clusters on the rocks and may be numerous in estuaries. They are in season from September to April, but are at their best in autumn. Mussels are very prone to pollution by sewage, but if placed under suitable conditions in pure water they can cleanse themselves within a few days. Stale or dead mussels gape and rapidly become offensive; they are usually sold in canvas bags, and if stale, will rattle, giving a distinctive noise from gaping and separated shells.

Escallop.—This bivalve has two beautifully ribbed fan-shaped shells, the hinge being at the narrow end of the fan; the left shell is more or less flat, the right more arched. The colour of the shells is brownish pink outside and pearly-white edged with pink inside; they are between 4 and 5 inches across. The flesh resembles a poached egg, the roundish white mass having an orange " foot " partially encircling it. The fish are plentiful around the British Isles, and being found in deep water they are not so liable to contamination. They are in season throughout the year, but are in best condition during the cold weather. The shells may gape even when the fish is alive; touching or tickling the beard surrounding the body will bring about movement if fresh; the inspector should smell the bivalve, when staleness or decomposition can be detected.

Cockles are more or less heart shaped molluscs with two equal thick ribbed shells. They are found in the estuaries and bays near low-water mark in the British Isles. They possess a " foot " with which they burrow into sandy mud. They are obtained throughout the year, but are best during its latter half. When fresh the shells are generally closed; if open they will close on being handled unless the fish is dying or dead. When stale they rapidly become offensive.

Periwinkles, Wilks, or Wulks are molluscs which possess a single whorled shell like that of the snail, with a circular opening through which the " foot " emerges for progression. They are numerous around the British Isles and many are also obtained from Holland. They are seasonable all the year round, but are best during the colder months of the year. The inspector should note the condition of the foot, which should not be shrunken, and he should smell the winkles as they rapidly become offensive if stale. When in bags it is best to condemn the whole bag if some are found to be stale as the juices from them will soon contaminate the fresh fish.

Whelks are single shelled molluscs, with large snail-like shells whorled and ridged and ending in a point; the basal opening is large and from it the foot protrudes. They are plentiful all round the British Isles, and although in season throughout the year are best in spring. When de-

composing they are very clammy when drawn from the shell and smell offensive.

Crustaceans.

CRABS are crustaceans in which the head and thorax are united to form a short compressed body which is enclosed in a hard limy shell, the abdomen or tail being curved under the thorax. They possess large claws and four pairs of legs. The shell is cast from time to time as the animal grows, and when without a shell, or during the period of casting when the shell is forming, they are known as "soft shelled crabs" and the sale of such crabs is contrary to Oysters, Crabs and Lobsters Act, 1877. The crabs exposed for sale in this country are obtained from the British Isles, and are practically in season throughout the year, although their condition is best during the months of April, May, June, and July.

THE LOBSTER GROUP.– The lobster, crayfish, prawn, and shrimp are long-tailed crustaceans with many jointed bodies, and all possess ten legs, two of which form claws or pincers, and the other four pairs form legs and swimlets under the fan-shaped tail.

The LOBSTER is encased in a hard shell, of blue-black colour which turns brilliant red when cooked. The claws of the lobster are proportionately large, but are unequal in size. The bodies are many jointed and the antennæ are small. Like crabs, lobsters cast their shells and may not be sold while in the soft state. They are in best condition during the summer months and are obtained from the British Isles and from Norway. Lobsters vary in size, but the best table size is from one to two pounds in weight. It is against the law to sell, expose for sale or buy for sale, any lobster which measures less than eight inches from the tip of the beak to the end of the tail when spread as far as possible flat. (Oysters, Crabs and Lobsters Act, 1877.)

When freshly caught the claws retain their muscular action, which can be elicited by pressure on the eyes; if absent the lobster is not fresh. Even when boiled the tail of the lobster should preserve its elasticity; if absent the lobster is stale. Lobsters are sent to market alive and boiled by the fishmonger, being plunged into boiling water containing salt and boiled for about twenty minutes.

The CRAYFISH is like a miniature lobster, but is a fresh-water crustacean; its antennæ are longer and its claws more equal in size than those of the lobster. The colour of English crayfish is greyish, the Norwegian more reddish pink; after boiling they are of a deep red-pink colour. They are cooked in the same manner as lobsters.

PRAWNS are also like little lobsters, but have small pincers and possess long saw-edged beaks with protruding horns. When alive their colour is greyish with markings of red; they are sometimes semi-transparent, but when boiled become bright red. They are obtained in quantities around the coast of the British Isles and are generally about three inches

long. A larger variety known as the Dublin prawn is often on sale, measuring about five inches. Prawns are in best condition during the summer months. They do not carry well when alive, and are generally plunged into salt water and boiled for about eight minutes before being sent to market.

The SHRIMP is very similar to the prawn, but is smaller and does not possess the horn on the snout. Two kinds of shrimp are marketed, the pink and the brown; the former is found in deep water, the latter in estuaries and sandy beds. They are cooked in boiling salt-water for five to eight minutes and become brown in colour; they are then packed in barrels, or hampers, and sent to market. Shrimps are in best condition during the summer, but are in season throughout the year. They are obtained mainly from the British Isles and Holland. When fresh the shrimp is crisp and the tail curled under the body, the shell is a good clear colour, and the eyes are prominent. When stale the fish has an objectionable odour, not unlike ammonia, and is limp with straight inelastic tail. They are apt to become heated and sticky, and will then quickly decompose.

SHELLFISH IN RELATION TO DISEASE

All shellfish, such as oysters, mussels, cockles, and whelks, intended for human consumption should be obtained from clean "layings", "beds", "ponds", or shores where sewage cannot gain access to them. Outbreaks of enteric fever have from time to time been attributed to the consumption of polluted shellfish, and it appears probable that, in the past at any rate, the consumption of such shellfish had important influence in maintaining the prevalence of the disease.

In connexion with outbreaks caused by polluted shellfish two types of illness not infrequently occur, namely, bacterial food poisoning, which manifests itself soon after consumption of the shellfish, and enteric fever, which appears after a period of incubation.

Enteric Fever.

One of the best-known outbreaks of this nature occurred in 1902, and was investigated on behalf of the Local Government Board by Dr. Bulstrode. The particulars were briefly as follows:

Municipal banquets were held on the same day at Winchester and Southampton. The number of guests present at the Winchester banquet was 134, and at that at Southampton 133. Shortly after both banquets, the time varying from a few hours to three or four days, a large number of the guests were attacked with gastro-intestinal disorders, 52 being

affected in this manner at Winchester and 54 at Southampton. Most of those persons recovered rapidly. Between two and three weeks after the banquet, however, 10 persons who had been at Winchester, and 11 who had been at Southampton, developed enteric fever.

In order to gain information as to sources of infection Dr. Bulstrode sent a copy of the banquet menu to each patient, requesting him to mark on it every article he had partaken. The information thus obtained pointed clearly to the oysters as the source of infection. It was then found that the supply of these molluscs for the two banquets had been procured from the same source, namely, oyster ponds at Emsworth. Investigation showed that there had been a number of cases of enteric fever at Emsworth. The sewer receiving the sewage of the infected houses discharged its contents into the sea at a point closely adjoining the oyster ponds. The ponds were covered with sea water at high tide, and thus the oysters were contaminated with specifically infected sewage.

Dr. Bulstrode summarizes the facts as follows:

1. "Two mayoral banquets occur on the same day in separate towns several miles apart.

2. "In connexion with each banquet there occurs illness of analogous nature, attacking, approximately speaking, the same percentage of guests and at corresponding intervals.

3. "At both banquets not every guest partook of oysters, but all those guests who suffered enteric fever, and approximately all those who suffered other illness, did partake of oysters. The exceptions to this rule appear insignificant when all the facts are marshalled.

4. "Oysters derived directly from the same source constituted the only article of food which was common to the guests attacked.

5. "Oysters from this source were at the same time and in other places proving themselves competent causes of enteric fever."

Cockles.—Cockles have also proved themselves capable of conveying enteric fever. In 1903 an outbreak of this disease, due to the ingestion of cockles gathered from the foreshore at Lochgilphead, occurred in Glasgow, and was reported on by Drs. Chalmers and Knight. There were twenty-five cases. Inquiry as to immediate bad effects showed that among those who subsequently developed enteric only three had been affected by primary symptoms of vomiting and diarrhœa. Among those, however, who ate shellfish, but who did not thereafter develop enteric, were many who suffered from gastro-intestinal irritation, and Dr. Knight, who reported on the subject to the Local Government Board, suggests that the diarrhœa and vomiting may, by getting rid of the specific infection, have been the means of saving those affected by such symptoms from subsequently contracting enteric fever.

Sir Arthur Newsholme was one of the first persons in this country to demonstrate the causal relationship between the consumption of polluted shellfish and enteric fever, and the annual reports written by him whilst

he was *Medical Officer* of Health for Brighton contain much valuable *information on the subject. Thus during the nine years 1894–1902, out* of 643 local cases of the disease, no less than 238 could be ascribed to the consumption of polluted oysters and other shellfish, chiefly mussels.[1]

The annual reports of the late Dr. Niven, the Medical Officer of Health for Manchester,[2] contain particulars of the observed relationship between shellfish (especially mussels) and enteric fever during a long period of years. Many of the epidemiological inquiries were made by Dr. J. R. Hutchinson and Dr. Barbara Cunningham. During the three years 1905, 1906, and 1912, when the facts were most fully and carefully investigated, a total of 967 cases of enteric fever occurred in Manchester, of these 341 (of which 67 were fatal) were attributed to shellfish (chiefly mussels), and 626 (of which 115 proved fatal) to other causes.

If the persons attacked by enteric fever under 15 years of age are excluded the figures become more striking, namely, 300 attributed to shellfish and 387 to other causes.

Mussel Poisoning.—Mussels occasionally give rise to symptoms of poisoning. The most common form, sometimes known as "musselling", is due to properties inherent in the shellfish, and is non-bacterial in origin. The chief symptom is an erythema or "nettlerash" which is often accompanied by intense itching. The patient may also suffer from vomiting and diarrhœa. The illness is of short duration and complete recovery generally takes place. A very similar form of illness may result in certain susceptible persons from the consumption of crabs, lobsters, strawberries, and other forms of food.

Bacterial Food Poisoning from Shellfish.—The occurrence of bacterial food poisoning soon after the ingestion of polluted shellfish has already been alluded to on p. 252. In such instances the shellfish are the vehicle by means of which the harmful bacteria (probably of the Salmonella group) are introduced into the system. For symptoms of the poisoning, &c., see p. 329.

Notes on Shellfish.—Great care should be exercised in making inquiry respecting the circumstances associated with cases of enteric fever which are believed to be due to the consumption of polluted shellfish.

Study of the different questions involved in connexion with the influence of polluted shellfish in maintaining enteric fever prevalence is rendered difficult on account of the absence of sufficient detail in many of the reports written on the subject. In some instances the only information given in the report on a case of enteric fever, which the writer attributes to the consumption of shellfish, is a statement to the effect

[1] Annual reports of the M.O.H. for Brighton, 1894–1902. Fourth report of the Royal Commission on Sewage Disposal, Vol. II, 1904.

[2] *Observations on the History of Public Health Effort in Manchester*, 1923, by Dr. James Niven, p. 51.

that the patient, prior to the onset of his illness, had consumed shellfish, or that he was in the habit of eating shellfish from time to time. Such a statement is obviously of little value, as it merely implies that the patient has recently eaten something which may occasionally be the vehicle by means of which the infection of enteric fever is spread, but it is no proof that the shellfish were the cause of the illness. It is necessary to make careful inquiry in each instance concerning the other possible sources of infection to which the patient may have been exposed. If, by a process of exclusion, these can be eliminated, then the date or dates on which shellfish were eaten should be ascertained, and consideration given to the question whether these dates fall within the infective period, namely, within about three weeks of the date of onset of the patient's illness. It has been noted that the incubation period of enteric fever in cases attributed to shellfish consumption is sometimes shorter than usual, and it may be contended that fourteen days rather than three weeks should be regarded as the infective period, but, in view of the insidious character of the disease in its early stages, it is often difficult or impossible to determine the exact date of onset of illness, and the patient may ail for some time before definite symptoms manifest themselves.

It is important also to know what sort of shellfish were consumed, and whether they were eaten in the raw or the cooked condition. In the latter case attempt should be made to discover the method of cooking employed, with the view of determining whether it would be likely to sterilize the shellfish. The source from which the shellfish were derived is a matter of great importance, in order that inquiry can be made as to whether or not the beds or layings in question are liable to sewage pollution, and whether other cases of enteric fever have been attributed to shellfish from the same fishery.

It not infrequently happens that persons belonging to the working classes are very reluctant to admit that they have eaten shellfish, and, unless very careful inquiry is made, the possibility of the infection having been derived from this source is liable to be overlooked.

Re-laying of Shellfish.—It is well known that if oysters or mussels are removed from sewage-polluted waters and re-laid, under suitable conditions, in clean sea water, they cleanse themselves from undesirable organisms in the course of a few days. Polluted shellfish are by this means rendered fit for human consumption.

Unfortunately, in many of the estuaries in which mussel fisheries are carried on, no place can be found where the water is sufficiently pure to afford satisfactory means of cleansing the shellfish by ordinary methods of re-laying. With the object of overcoming this difficulty, the Ministry of Agriculture and Fisheries have devised a system by which polluted mussels may be cleansed in specially constructed tanks containing sea water rendered sterile by means of chlorine. This system was first adopted at Conway, and the Ministry of Agriculture and Fisheries claim that

the scheme has proved a complete success, not only from a scientific point of view but as a commercial proposition.[1]

Cockles and other shellfish are sometimes subjected to a process of sterilization by steaming under pressure in specially constructed autoclaves made for the purpose. If the process is efficiently carried out the shellfish may be regarded as safe for human consumption. (See also remarks on the Public Health (Shellfish) Regulations, &c., p. 507.)

METHODS OF PRESERVING FISH

Fish are preserved by salting, pickling, drying, smoking, and by means of ice; some are also canned or tinned.

Ice Preserved Fish.—Ice is utilized in many ways for the preservation of fish. Blocks of ice may be seen in most fishmonger's shops to keep the surrounding air cool and preserve the fish as fresh as possible, and fish are often packed into boxes between layers of crushed ice. Brine may be used along with the ice, and various refrigerating systems are employed. Since the introduction of trawling with the increased distance from port to fishing ground, it has become necessary to keep fish fresh for from two to three weeks at sea, as the trawlers often remain at sea for considerable periods until their catch is complete. Fish are commonly preserved by being placed in layers in the hold, with a thick sprinkling of crushed ice between each layer. The fish are generally gutted and put into ice as soon as practicable after the process of gutting is completed, and the hold made practically airtight (so as to obtain as low a temperature as possible) where the fish are stored while returning to port.

Many of the newer trawlers are fitted with refrigerating plants, and fish are frozen as soon as caught; such fish carry well when sent inland. In some cases brine instead of plain water is used; this reduces the time necessary for freezing and preserves the fish with less alteration in flavour and texture.

A " package " or " carton " system of packing has been introduced, the fish being filleted, frozen in brine, and then packed closely in cardboard boxes which have been treated with paraffin wax; they are then wrapped in grease-proof paper and packed in the refrigerator. The packages should be kept in a refrigerator at the place of retail sale until delivered to the customer, when the fish will be found to be in good condition.

[1] See *Ministry of Agriculture and Fisheries Report on Mussel Purification*, by R. W. Dodgson, M.D., 1928.

Salting.—Herrings are frequently packed in salt for exportation; on arrival at the port they are gutted and mixed with fresh salt and packed into barrels, back downwards, as tightly as possible without injury to the fish. Salt is sprinkled between each layer, and before dispatch, the fish having settled, the barrels are filled up with salt brine, before being battened down for export.

Smoked Fish.—Various forms of smoking are carried out after salting for different kinds of fish, e.g. herrings may be eaten fresh, salted, cured, or smoked as bloaters, kippers, or red-herring.

BLOATERS are herrings which have been well sprinkled with salt or put into brine for some hours, placed on rods and afterwards dried in the curing house over a coke fire, or they may be dried in the open without heat.

KIPPERS are herrings which have been split, gutted, and thoroughly washed, then soaked in special brine, and thereafter smoked over smouldering wood chips. Sometimes herrings are boned before being kippered.

RED-HERRINGS are herrings which have not been gutted, but are cured in salt. When fresh they are placed in salt and allowed to remain until such time as they may be required for smoking. The salt causes the herring to shrink; they are therefore put into a vat of cold water until they regain their shape, and are then put on to rods in the smoke house, either up at the roof in a house which is being used for curing haddocks, where they can remain until sufficiently smoked, or they may be smoked separately on several occasions.

FINDON-HADDOCKS are fresh haddocks which have been gutted, beheaded, split, washed, pickled in brine, and finally smoked by being strung on thin steel rods or hung on tenter hooks over peat or wood chip fires.

SMOKED FILLETS.—Haddocks, cod, and other fish are filleted, coloured with " annato " substitute, soaked in brine and finally smoked. Colouring by means of aniline dyes is contrary to the Public Health Preservatives in Food, &c., Regulations. Annato substitute is used instead of dyes, but the latter may still be detected, the test being to add a few drops of sulphuric acid; a blue colour will indicate the presence of an aniline dye.

Canned Fish.—Many varieties of fish are canned: some are cut into small pieces and canned in the ordinary way, such as cod, salmon, crabs, lobsters, &c.; others are preserved in oil, such as sardines, sprats, anchovies, mackerel, &c.

Fish Pastes.—Fish are made into pastes and potted or tinned, e.g. shrimps, anchovies, and salmon.

The inspector should examine cured and canned as well as fresh fish. The method of examining canned foods is described

on p. 311, and need not be further discussed. Decomposition in cured fish may be detected by its unpleasant odour. If kept in a damp place black spots may appear on the fish due to the fish mite. A rust-red colour due to a specific organism is sometimes seen on cured fish, particularly salted dried cod; it is popularly known as "red fungus", as it was formerly thought to be caused by a fungus, but has been found to be due to a "red coccus". The organism appears in well-defined coccus and sarcinal growths. A second unidentified organism is also associated with the condition. Such fish should be condemned, although no known disease is produced by the consumption of fish so infected.

Fish Oil.—Oil is separated by means of steam from the liver of cod and halibut, and is used for medicinal purposes. Cod liver oil is more readily absorbed than other fats, and as it contains vitamin A (the growth and health promoting vitamin) and vitamin D (the antirachitic vitamin) in considerable quantities it is valuable as a food in wasting diseases, such as tuberculosis and as a preventive and curative agent for rickets in children.

Halibut oil is stated to contain both vitamins A and D in higher proportions than are present in cod liver oil, and it is being substituted for the latter by some firms.

SPAWNING SEASONS OF FISH

Coal-fish, plaice	January	to	May.
Cod, pollock	February	,,	April.
Dab, flounder, whiting ..	February	,,	June.
Salmon in England	2nd February	,,	31st August.
Meagrim, skate	March	,,	May.
Hake, sole	March	,,	June.
Ling	March	,,	July.
Halibut	April	,,	May.
Brill, tusk	April	,,	June.
Lemon sole, turbot	April	,,	August.
Mackerel, mullet	May	,,	June.
Witch	May	,,	August.
Haddock	May	,,	February.
John Dory	June	,,	August.
Cat-fish	November	,,	January.
Herring	All the year.		

CHAPTER II

Poultry, Game, and Rabbits

National Mark Scheme—Killing of Fowls—Diseases of Poultry—Tuberculosis—Chicken Cholera—Fowl Typhoid—Fowl Pox—Bacillary Diarrhœa — Black Head in Turkeys — Coccidosis — Worms—External Parasites.
Inspection of Poultry.
Feathered Game: Aspergillus Pneumonia of Pheasants—Inspection.
Rabbits: Coccidosis — Tuberculosis — *Cysticercus pisiformis* — *Cysticercus serialis*. Inspection.
Hares.

Poultry both from home and abroad is largely used as an article of diet, and within recent years the Ministry of Agriculture has done much to promote the poultry industry in this country. The most commonly used are: fowls, ducks, geese, turkeys, pigeons, and guinea-fowl.

Under the Agricultural Produce (Grading and Marking) Act, 1928, a National Mark Poultry Scheme has been devised, which sets out a standard for classification and quality as well as for the nomenclature and packing of poultry.

Fowls.—A healthy fowl should possess the following characteristics: feathers glossy, eyes bright, nostrils free from discharge, movements active, combs and wattles firm and bright in colour (as a bird grows older its comb and wattles become darker).

The usual method of killing fowls adopted in this country is to dislocate the neck and thereafter to hang the bird up by the feet so that all blood shall drain from the limbs and body into the dependent head. Fowls are sold either in feather or plucked. In the latter case plucking should be carried out before the body is cold, as it is easier done at this time, and the skin is less liable to injury. Fowls are usually marketed undrawn, as drawn poultry decomposes rapidly when exposed in shops.

Common Diseases of Poultry.

Tuberculosis.—Fowls are susceptible to human tuberculosis, but there is also an "avian" form of the disease, the bacillus of which differs somewhat from the human and bovine varieties. The disease spreads rapidly among fowls by contact, and probably also by means of excreta.

SYMPTOMS.—The course is somewhat prolonged, the affected bird becomes anæmic, the comb and wattles are pale, it gradually loses flesh. Lameness is a common symptom accompanied sometimes by swelling of the joints.

ORGANS AFFECTED.—The liver and spleen are generally attacked; they become enlarged and are found to be studded with nodules, of whitish or yellow colour, varying in size from that of a pinhead to a pea. So long as the disease is confined to the spleen the birds remain plump and in good condition; when, however, the liver becomes involved, the bird is generally found in an emaciated condition.

Moule gives an interesting account of how the people in a certain French village where tuberculosis was prevalent among the poultry were in the habit of preparing a *pâté* from fowl livers in an early stage of tuberculosis, believing that they were dealing with true fatty disease of the liver, which is cultivated in the preparation of *pâté de foie gras.*

A case is recorded where a severe outbreak of tuberculosis in a poultry yard was traced to the caretaker, who was suffering from phthisis, and there seems little doubt that he infected the birds with his sputum, the grain becoming contaminated at feeding times. Other cases of the prevalence of this disease among poultry have been traced to their being fed on the infected organs of tuberculous cattle.

Chicken Cholera is a rapidly fatal disease, due to Metchnikoff's spirillum, an organism closely resembling the true cholera spirillum. It is fatal to pigeons and rabbits. The incubation period varies from sixteen to twenty-four hours, and death generally occurs in from thirty-six to forty-eight hours.

SYMPTOMS.—There is a whitish discharge from the eyes, nose, and mouth; the birds suffer from diarrhœa, the evacuations being fluid and of a greenish colour. They, as a rule, pass into a sort of stupor, and sit with their feathers ruffled. The stupor generally gives way to convulsions, which terminate in death.

After death the flesh is found redder than normal; the intestines contain a greyish yellow fluid, sometimes slightly blood-stained, in which the specific organisms are found.

Fowl Typhoid.—This is an acute disease, for the most part confined to adult birds, caused by the *Bacillus gallinarum.*

SYMPTOMS.—The bird stands with feathers ruffled, away from the light, and frequently passes liquid, fœtid, droppings. In the majority of cases death occurs in from 4 to 12 days. The liver and spleen are enlarged,

and the first part of the small intestine is inflamed; there is, however, little which is really distinctive to be found post-mortem.

Roup, Fowl Pox, or Fowl Diphtheria.—A very common contagious disease of adult fowls, believed to be caused by a filterable virus. Fowls, pigeons, and turkeys may be affected. The disease occurs in one of three forms or in a combination of them. Sometimes the mouth is mainly affected, showing growth of a membrane very similar to that of human diphtheria, although in no way related to that disease. The membrane is greyish and adherent, becoming yellowish later, and, if separated, the underlying tissues are seen to be raw. The bird may die of suffocation, through the stoppage of the air passages by a thick exudate, or it may die from diarrhœa and the effects of toxins. In other cases the wattles, comb, and skin of the head are covered with nodules which may be cauliflower-like in appearance. In yet a third group the disease is marked by discharge from the nose, eyes, and mouth. The intensity of the illness varies, sometimes causing a high death rate, while at others only a small number of the affected birds die.

Bacillary White Diarrhœa of Chicks.— A very fatal disease caused by the *Bacillus pullorum*, it occurs mainly in chicks which are artificially incubated. The condition is characterized by the presence of whitish yellow diarrhœa, which appears within the first few days after hatching of a brood. The disease is mainly disseminated through egg infection.

Black Head in Turkeys.—This disease is thought to be due to an amœba, and is characterized by a contagious condition resulting in inflammation of the liver and intestine. It is most often seen in young turkeys, but chicks may also become infected. Sick birds lose condition rapidly, become weak, and frequently pass droppings of yellowish green colour. Post-mortem the liver is enlarged and is seen to be studded with round-shaped necrotic areas of a green or yellow colour. The cæcum is frequently involved, and may be covered with a cheesy exudate.

Coccidosis in Poultry.—Various coccidia affect different forms of poultry, but the coccidium, *Emeria tenella*, is said to infect fowls, turkeys, and pheasants. The disease is protozoal and the parasite invades the intestines, except in the case of the goose, when the kidney is attacked.

The symptoms are very similar to those of bacillary white diarrhœa, and a true diagnosis can only be made in the laboratory. The cæcum is seen, post-mortem, to be much thickened and to contain cheesy material; white spots are present on the intestinal walls.

Favus.—This is a parasitic disease caused by a fungus, the *Lopophyton gallinæ*, and is characterized by the appearance of small spots on the comb and wattles; these spread and form yellowish crusts giving off a mousy odour. The feathered skin may become infected and be covered with yellow scabs. Man may be infected from handling infected birds, and the disease is liable to be spread from bird to bird in the poultry yard.

Worms of Poultry.—Poultry are liable to infection by many kinds of worms.

Gapes is caused by the Gape worm or *Syngamus trachea*, a round worm which infests fowls, turkeys, pheasants, partridges, and many of the song birds. The worm which lives in the wind-pipe and sucks the blood of its host may cause suffocation if present in large numbers. It is of a bright red colour, therefore known as the " red worm ". Young chicks and turkeys of from two weeks to four months are most commonly affected.

The disease commences with an irritating cough, and the bird stretches out its neck in an effort to get more air; it keeps its mouth open or gapes (hence the name), and death occurs early from suffocation in many cases.

Intestinal Worms.— Tapeworms of several kinds infest the intestinal tract of poultry, but as far as is known none is communicable to man. Many round worms are also seen in the intestines of poultry; the most common in the small intestine is the *Ascaridis galli*, and the cæcum worm is that most frequently found in the cæcum.

External Parasites.—Poultry are susceptible to many external parasites, including fleas, bugs, lice, and mites. If not kept under control these parasites are responsible for loss of condition, and may even cause death from irritation and interference with rest.

Inspection of Poultry in the Dead State.—The feet should be limp and pliable; stiff dry feet belong to a stale bird. If the bird be plucked there should be no discolouration of the skin and no odour. The flesh should be of a pink or yellow colour according to breed, firm, elastic, and plump, and the breast-bone should be unbroken. If there be any discolouration it generally appears on the back before the breast.

Stale poultry becomes bluish in colour, often green over the crop and abdomen; the skin breaks readily, and the bird may possess a disagreeable odour. Poorly fleshed birds should be carefully examined, as emaciation is frequently seen in tuberculosis and gastro-intestinal diseases. A hard swelling of the abdomen accompanies purulent peritonitis.

Age of Fowls.—Young fowls may be distinguished from old by the following characteristics. In the young bird, when in feather, down is seen under the wings, the plumage is not fully developed, the comb is smooth and thin, the feet are smooth, and the claws sharp; the beak and breast-bones can be bent. An old bird has fully developed plumage, its feet and legs are rough, and the claws coarse; the comb is thicker and the beak and breast-bone are hard and unbendable.

Feathered Game.—The following game birds are commonly sold in this country: pheasant, partridge, grouse, blackcock, snipe, wild duck, teal, widgeon, woodcock, ptarmigan, plover, &c. Game is frequently proffered for sale in a semi-decomposed condition, but it cannot be seized on that account, as "high" game is looked upon as a delicacy by many persons.

ASPERGILLUS PNEUMONIA.—The aspergillus fungus is responsible for producing a condition of pneumonia in game birds. The pheasant is prone to infection. Post-mortem the lungs show characteristic signs of pneumonia, and in the stage of grey hepatization the disease may be mistaken for tuberculosis. In aspergillus pneumonia there are no foci of caseation and calcification.

RABBITS AND HARES

Rabbits.—Large quantities of rabbits are consumed in this country; they are shot, trapped, and netted. Rabbits are imported from Belgium in the fresh state, and frozen from Australia and New Zealand. British rabbits are sold throughout the year, but are in best condition during the winter months. The average weight of a good wild rabbit is from 3 to 4 lb. before it is dressed.

DISEASES OF RABBITS

COCCIDOSIS.—An organism known as the *Coccidium oviforme* attacks rabbits; an acute form is met with in young and a chronic in older animals. In the acute form the rabbit becomes rapidly emaciated and suffers from diarrhœa; death rapidly supervenes. On examination, except by the microscope, the disease is difficult to diagnose, as inflammation of the intestine may be the only sign. In the chronic form the animal becomes emaciated, suffers from nasal and eye discharge and from diarrhœa. Changes are found in the liver and intestines; white spots up to the size of a pea may be seen in both liver and intestines, and these patches contain a cheesy material, but in some cases signs of inflammation only are present. The white spots consist of distended ducts filled with large numbers of coccidia.

TUBERCULOSIS.—Tame rabbits are liable to human, bovine, and avian tuberculosis, the wild animal being rarely affected. The disease may be localized in the lungs or may be general, the appearances being like those of tubercle elsewhere. Lesions may also be seen in the organs, especially the liver and the glands in its neighbourhood.

TAPEWORMS.—Cysts of two tapeworms are commonly found in the rabbit.

CYSTICERCUS PISIFORMIS.—These cysts are frequently seen on the peritoneum, around the stomach, liver, and intestines in the omentum. They are about the size of a pea, and on each can be seen a white spot which corresponds to the site of the head of the tapeworm. The rabbits are often emaciated and unfit for food, but they may be in good condition, when the cysts can be stripped and the carcass passed for food (see p. 135).

CYSTICERCUS SERIALIS.—These cysts occur under the skin, generally around the shoulder and along the inner surfaces of the thighs, and can be felt as elastic swellings varying in size from that of a hazel-nut to that of a hen's egg. They are easily seen when the animal is skinned. The adult worm is the *Tænia serialis* of the dog, which becomes infected through eating rabbit flesh containing the cysts. The flesh in this affection is often pale and flabby, in which case the rabbit should be condemned (see p. 135).

Rabbits are liable to mange, favus, and ringworm.

INSPECTION OF RABBITS

The flesh of a newly killed rabbit has a moist and bluish appearance, and when in good condition there is abundance of fat round the kidneys. The flesh of Belgian or Ostend rabbits is whiter and has less flavour than the wild variety.

Young rabbits have short stumpy necks, smooth sharp claws, their ears are soft and thin. A thick haunch, rough, dry and blunt ears, and ragged claws are characteristic of old animals.

Belgian rabbits are skinned and dressed before being packed, and it is not unknown for the carcass of a cat to be substituted in a package of rabbits. The distinguishing features between the cat and rabbit are the head and claws, but these are generally removed.

The head of the cat is broad, its teeth do not show the prominent rodent incisors, its tail is long and pointed; the rabbit has a thinner head, a short stump of a tail, and it has no claws at the digit ends corresponding to those of the cat. The cat has thirteen pairs of ribs, the rabbit twelve; the chest of the cat is more barrel-shaped, and it is broader at the loins. The kidneys of the cat are level in the body and of a pinkish colour; those of the rabbit are chocolate coloured and the right kidney is nearer the head than the left. (See skeletal differences, p. 24.)

Stale rabbits in their skins can be detected by the dullness of their eyes and the ease with which patches of the fur can be removed,

and by the slimy or sticky appearances of the interior of the carcass. They rapidly become offensive when decomposition sets in. Skinned rabbits have the eyes as well as the fur removed; decomposition is then detected by the odour and by the condition of the inside of the carcass.

Frozen rabbits are packed in crates after being eviscerated, but are not skinned. In Australia rabbits are graded into first and second grades according to the size and quality. Imported frozen rabbits decompose rapidly when removed from cold storage, and no one who has experienced the smell of rabbits which have begun to decompose while thawing in the sun is likely to mistake the odour. Suspect rabbits should be allowed to thaw out in order to make sure of their condition.

Hares.

Hares are common in the British Isles, but are also imported in large numbers from Australia, China, and Russia. A young hare is known as a leveret, and can be distinguished from the adult animal by its short stumpy neck, large knee joints, short smooth claws, and small lip-cleft, but particularly by a knob which is found under the first joint of the fore-foot. An old hare has a markedly cleft lip, long blunt claws, tough ears, and no knob under the fore-foot joint. In the mouth of all hares there are two small incisors behind the large front ones in the upper jaw, and these serve to distinguish the hare from all other rodents.

Hares are sold in all conditions, and the inspector would find it difficult to condemn the flesh of these rodents unless it were definitely decomposed.

CHAPTER III

Eggs, Cereals, Sugar, Beverages, and Condiments

Eggs: Freshness—Tests—Defects—Preserved Eggs—Frozen Eggs —Marking of Eggs.
Cereals: Wheat Group (wheat, barley, rye)—Pea Group (pea, bean, maize)—Sago—Tapioca—Oats—Rice—Arrowroot—Parasites of Grain.
Sugar: Cane Sugar—Beet Sugar.
Beverages: Tea—Coffee—Cocoa—Spirits—Beer—Wine—Cider.

EGGS

The consumption of eggs in this country has reached enormous proportions, and, as the demand exceeds the home supply, large quantities are imported. Further, as the production of eggs is more abundant during certain seasons of the year, it is customary to preserve the surplus for use at times when fresh eggs are scarce. Thus it is usual to find eggs sold in our shops under the following designations, namely, "Fresh-laid English Eggs", "Fresh Imported Eggs", and "Preserved Eggs".

Fresh Eggs.—A new-laid egg has a partially glazed shell with "bloom" on it. The air-space between the top of the shell and the fluid contents does not measure more than $\frac{1}{4}$ inch in depth. The yolk floats in the shell interior. The egg should weigh heavy for its size. On opening a fresh egg there is no unpleasant odour; the white is clear and the yolk yellow, varying from canary colour to orange and unspotted.

Tests for Egg Freshness.—"Candling" is the process by which eggs are held between the observer and a lighted candle in order to detect the size of the air-space and any changes within the egg. Expert testers examine eggs in a dark room, and employ a lantern with a lighted bulb in its interior and an aperture less in diameter than that of the egg; the egg is rotated between the tester and the aperture in the lantern case.

The air-space, which in a fresh egg is not more than ¼ inch in depth, increases in proportion to the staleness of the egg, with the result that the egg becomes lighter in weight as the air content increases, and will float if placed in water. The yolk in a fresh egg should be represented by a faint shadow, of equal intensity throughout; should mottling be present it indicates that the internal membrane is adherent to the shell in places. If "blood spot" is present it can be detected by a dark area on the yolk shadow. In partly incubated eggs the yolk does not float but adheres to the side of the shell.

Defects in Eggs.

STALENESS is detected by the light test, by the increase in the size of the air-space. There will be an unpleasant odour when the egg is opened.

WATERY WHITE.—A good egg has clear, pale, straw-coloured white. Eggs with watery white show increased mobility of the yolk shadow by the light test.

BLOOD SPOT.—This is said to be due to straining during laying; the blood drop adheres to the yolk of the egg. Such eggs may be used for cooking if the spot be small. The condition can be detected by the light test.

MOULD MARKS.—If moulds are present on the shells the eggs should be condemned.

RED-ROT, BLACK-ROT.—In this condition the yolk becomes red or black; these eggs must be condemned, and if the proportion sold by any one dealer is high, prosecution should be considered. Such eggs appear very dark before the candle.

Preserved Eggs.—Eggs are preserved in solutions of silica (water glass), lime water (bisulphite of lime), or may be refrigerated or frozen. When preserved in solutions of lime or silica the eggs are placed small end down, in pails or jars, and covered with the prepared solution. They should be kept in a cool place and neither moved nor shaken. The shells of such eggs lose their bloom; those in lime water become roughened, while those in water glass have a whitish dull appearance.

The temperature at which eggs are kept in a refrigerator should not be under 33° F., else freezing will result, and while in cold store the eggs should be rotated from time to time, in order to prevent the yolks from adhering to the sides of the shells. Refrigerated eggs do not retain the bloom on the shells.

Frozen Eggs.—The trade in frozen egg pulp was formerly a Chinese monopoly amounting to over £3,000,000 a year, but it has been challenged by the British Dominions; last year consignments of frozen eggs were imported from Australia, and it is hoped to capture the foreign trade. Egg pulp is prepared in the following manner: the eggs are tested, the shells are then broken, and the egg contents are strained in an electrical machine, after which they are frozen in large tins by a vacuum process. The tins are packed into the refrigerator and shipped to this country, where they are kept in cold store until wanted for use. The egg pulp is utilized by confectioners in the baking of cakes, &c. Two great advantages will result from the importation of Dominion egg pulp: firstly, it will provide a new line of industry for the Colonies, and secondly, it will assure a hygienic product, as the processes are carefully supervised and controlled in our Dominions, which cannot always be guaranteed in a foreign country.

Marking of Eggs.—Under the Merchandise and Marks Act, 1926, it is now compulsory for imported eggs to bear the name of the country of origin marked on their shells in ink, in letters of not less than 2 mm. in height. Under the Agricultural Produce (Grading and Marking) Act, 1928, all preserved eggs must be likewise marked.

A National Mark Egg Scheme has been instituted under the latter Act whereby those who so wish may apply for permission to use the National Mark. The eggs are tested, graded and divided into " special ", " medium ", and " pullet ", according to their size and weight. First quality eggs must have clean shells, must not have been preserved by any process, and must have firm translucent whites, translucent or faintly visible yolks, and the air-space must not exceed ¼ inch in depth.

CEREALS

The various kinds of grain used for food are known as cereals. Some of the cereals are used as whole grains, others are milled or ground into flour. The starch grains, or granules of the cereals, possess characteristic appearances which serve to distinguish the one from the other. Thus it is possible, by examining flour, meal, &c., under the microscope, to discover the particular cereal from which it was derived, and to say whether adulteration with any other cereal has taken place.

To carry out a microscopical examination, a minute quantity of the finest ground dust-like portion of the sample is placed on the centre of a glass slide, a drop of cold water is added, and the starch well mixed with

it. A cover glass is then placed on the top, and the specimen is ready for examination.

For identification purposes, the starch grains of the cereals may be divided into five groups; the cereals are therefore arranged in these groups in the following pages. It is not always easy to differentiate the individual members of the same group from one another, but it is usually at least possible to say to which group the cereal belongs.

The Wheat Group—Wheat, Barley, Rye.

WHEAT is the cereal most commonly used in Britain. A grain of wheat consists of three parts: (1) an outer protective covering called the bran, (2) the endosperm or kernel, (3) the embryo or germ of the young plant. The bran contains cellulose and mineral matter; the endosperm consists of a reticulum of cellulose filled with starch granules, while the embryo or germ is rich in protein and fat.

Flour is produced by grinding wheat. In the process of milling the wheat grain is broken up. The outer envelopes yield bran, middlings, sharps, and fine pollards; the germ is removed and the endosperm is converted into flour. Thus ordinary flour is derived entirely from the endosperm, the bran and germ being discarded. The germ is removed because it contains fat, which might become rancid, and enzymes, which by acting upon the starch of the flour tend to darken its colour. Unless very finely ground the bran is apt to be indigestible and to cause irritation of the gastro-intestinal tract. It is probable that too much has in the past been sacrificed in order to obtain a very white flour, and bread made of " wholemeal flour ", in which the separation of the bran is less complete, is now favoured by many.

A number of patent processes of milling have been devised. In Smith's patent the germ is treated with steam in order to destroy its ferment and to prevent the fat from becoming rancid. The germ is then ground fine; one part of this added to three parts of ordinary flour constitutes " Hovis flour ". In the Frame Food process most of the mineral salts and nitrogen are extracted from the bran by boiling it with water under pressure. After evaporation and filtration the resulting extract constitutes Frame Food Extract.

Wheat flour contains from 8 to 12 per cent of gluten, and is therefore specially suited for bread-making. (Rye also contains gluten, and can therefore be made into bread; but barley, oats, and rice, on account of the absence of this substance, are unsuitable for bread-making.)

ADULTERATION OF FLOUR.—On account of the low price of wheat at the present time, there is very little adulteration of flour in this country. Adulteration might be effected by the addition of the flour of other grains, such as maize, rice, rye, pea, &c. Such addition could easily be detected by the microscope.

Lolium temulentum, or darnel seeds, have occasionally been found *in flour. They produce sickness, delirium, giddiness, and symptoms of* narcotic poisoning. If alcohol be added to flour containing lolium, a greenish solution with a very unpleasant taste is produced; when added to ordinary flour, a yellowish solution with a pleasant taste results.

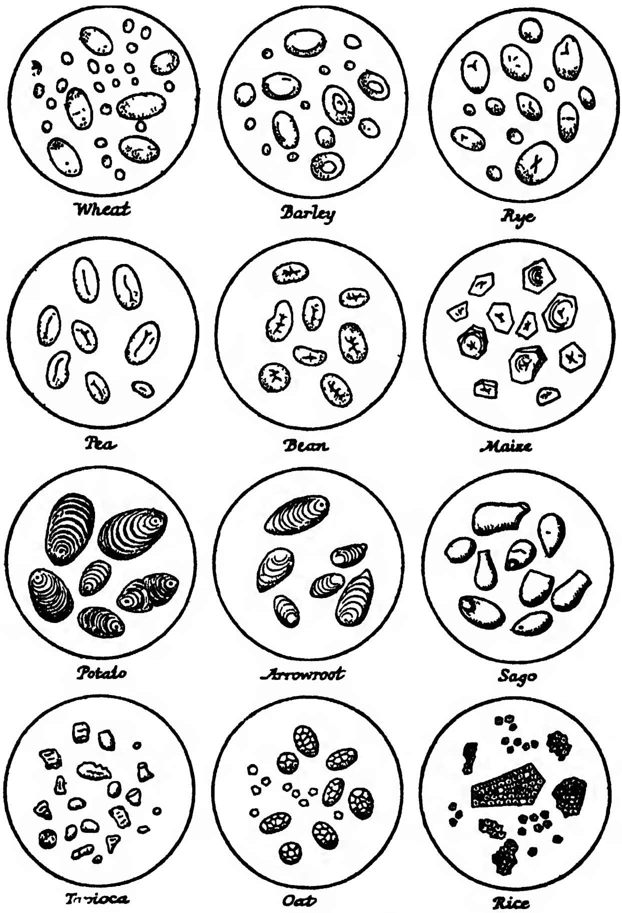


Fig. 2.—Starch Grains under the Microscope

Inspection of Flour.—Good flour should be white in colour (this quality depends somewhat upon the amount of bran which it contains). It ought to be free from odour and possess no acidity. Old or spoiled flour is generally yellow in colour and has an acid reaction.

Bread is made by mixing together wheat flour, a little salt and water,

and kneading it so as to form dough by the cohesion of the moistened gluten. The dough is charged with carbonic acid gas, which, by occupying innumerable little spaces or lacunæ, renders the mass porous. The carbonic acid is derived in one of three ways: (1) By the addition of yeast, which sets up fermentation, resulting in the formation of alcohol and carbonic acid gas. (2) By the use of baking powders containing dry alkaline carbonates, mixed with tartaric or other acid, which on being moistened give off carbonic acid. (3) By kneading the dough with water charged with carbonic acid gas under pressure (" aerated " bread).

Bread should be white. A yellow or dark colour may be due to old or inferior flour, bad yeast, admixture with rye, &c. It must be remembered, however, that wholemeal bread is not very white in colour. Acidity should not be present, it being generally due to old or inferior flour.

Barley.—The grain of this cereal may be prepared in various ways. If husked and polished it is known as " pearl barley ", and is utilized for making puddings, as thickening for soup, and for the preparation of " barley water ", &c. When husked and partly ground the grain is called " pot barley ", and when finely milled it is known as " barley meal ". Barley is used for the preparation of beer, yielding malt when partially fermented.

Rye is utilized for bread-making in many countries. Rye bread is more dense and moister than that made from wheat flour. Rye is attacked by the parasite which gives rise to " ergot ", the *Claviceps purpurea*.

Granules.—The granules of the " wheat group " are oval or circular in form, and have no very apparent hilum or concentric rings. The wheat granules are chiefly of two sizes—large and small—with few intermediate sizes. In the case of barley granules, intermediate sizes are more numerous, and slight concentric rings may be seen. The granules of rye are larger than the two former, and large, intermediate, and small granules are more equal in numbers. No concentric rings are visible, though a stellate hilum may occasionally be seen. Rye granules are imperfect, and cracks frequently appear in them.

The Oat Group—Oats and Rice.

Oats.—This grain is husked, or deprived of its integument, and when ground forms oatmeal, which is used for baking and for making porridge, &c. If old, oatmeal becomes stale and has a characteristic taste; it may contain mites, and a long whiskered mould may grow in it. The latter may be detected as " hairs " when the meal is run through the fingers.

Rice is the whole grain of the Paddy grass, which is grown in swampy ground in China, Japan, and some parts of India, Italy, and Spain. The husk is removed, and the grains are sold polished and unpolished. Polishing is accomplished by passing the grains over rollers covered with sheep-

skin. A certain amount of "French chalk" or a little oil may be used to assist in the dressing of the grain. Patna rice has long-shaped grains and is sold either polished or unpolished; it comes from Patna in India.

Rice may become infected by insects which render the grain unfit for food. Excessive French chalk is at times added and may be detected by microscopic examination.

GRANULES.—The starch granules of this group are very small—a high power being necessary for their proper examination. The oat granules are many sided. They cohere, forming round masses which are very characteristic. The granules of rice appear angular under a low power, but faceted under high powers. They form angular or irregular masses, and this distinguishes them from oats.

The Sago Group—Sago and Tapioca.

SAGO is obtained from the pith of the sago palm; the tree is cut into logs, and the pith is scooped out, well washed, and the resulting starch is heated on hot plates; small balls form, which are known as "pearl sago". Sago is greyer and less white than tapioca.

TAPIOCA is obtained from the root of the manihot plant, and comes from Brazil, Java, and the West Indies. The roots of the plant are reduced to pulp, the juice (which in some species contains prussic acid, a poison) is washed away, and the starch allowed to settle; this is then dried on hot metal plates and large or small pellicles are formed. Tapioca is used for puddings and in soups, &c.

GRANULES of this group are characterized by irregularity of shape. They have a hilum and rather faint rings. Sago granules are large and irregular, sometimes rounded at one end and elongated at the other. Tapioca granules are similar but smaller.

The Potato Group—Potato and Arrowroot.

POTATO.—The tuber of the potato plant is extensively used as a vegetable in this country. A raw potato when cut across presents three layers, an outer thin brown skin, an intermediate greenish layer, and a large central whitish zone known as the "flesh" of the potato. Many salts are contained in the greenish intermediate layer, the chief of which are the salts of potassium; these are lost when the potato is peeled before being cooked.

The flesh of the potato is composed of a juice which consists mainly of water, nitrogenous matter and salts, and a solid portion almost entirely made up of starch. When boiled the flesh becomes mealy, and when dried and powdered it is utilized as potato flour for baking purposes.

ARROWROOT is mainly obtained from the roots of the *Maranta arundinacea*, which grows in Jamaica and Bermuda. The roots of the young plants are dug up and reduced to pulp; thereafter they are washed, and the

starch which settles down is known as arrowroot. Great care is necessary in preparing, packing, and storing arrowroot, as it is liable to contamination from highly flavoured substances. Arrowroot is used for making cakes, puddings, &c.

Granules.—The granules of this group are large, oval or ovoid in shape, and with well marked concentric rings. Potato granules have a small but clear hilum at the narrow end and present an appearance not unlike an oyster. There are at least four different varieties of arrowroot, the starch granules of which vary somewhat in size and shape according to the particular variety. The hilum is generally at the broad end of the granule.

The Pea Group—Pea, Bean, Maize.

Pea.—The garden pea is eaten fresh, tinned, or dried. It contains much nitrogen in a proteid known as legumin, which is a valuable source of nourishment. Pea flour may be made from the dried peas.

Bean.—Several kinds of beans are used as vegetables in this country, such as the broad bean and the French bean; they are eaten fresh, tinned, bottled, or dried. They also are rich in legumin.

Maize.—Indian corn, or maize, is not eaten much in this country, but can be obtained in a fresh, tinned, or dried form. Maize meal is made by milling the grain after removal of the husk and germ. The flour prepared from maize contains no gluten and cannot be made into bread, but is utilized for baking various sorts of cakes. Adulteration of wheat flour with maize is not unknown as it is cheaper than the former, but in this country little adulteration is met with.

Granules.—In this group the granules are oval or round, without evident rings, but with deep, central, longitudinal clefts. Pea granules are generally of an elongated oval shape. They have a central linear depression, which is sometimes branched.

Bean granules are of a shorter oval than pea, and have irregularly shaped and branched central depressions. The granules of maize are polyhedral in shape, with a well marked stellate hilum.

PARASITES OF GRAIN, ETC.

Vegetable Parasites.

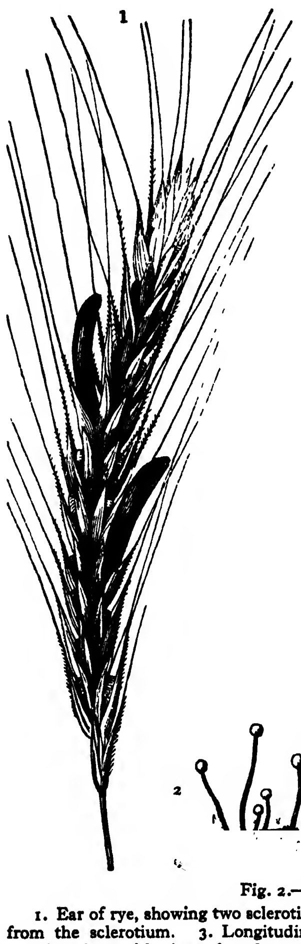
(*a*) Bunt, or *Uredo fœtida*, is found in the interior of the grain and may not be detected till the corn is ground; it gives rise to a disagreeable odour and a greasy feeling as well as dark colouration and pulverization of the grain.

(*b*) Smut, or *Uredo segetum*.—The spores of this parasite appear as a black dusty powder on the withered heads of affected corn. Under the

microscope the spores are seen to be small, smooth, spherical bodies, generally of a light-brown colour.

(*c*) Ergot, *Claviceps purpurea*, is a parasite which affects rye chiefly. When it attacks this cereal the mycelium of the parasite grows rapidly, replacing the actual grain and producing ergot. Ergot grains are two to three times as large as ordinary grains of rye. They are of a dark-purple colour outside, and cream-coloured in their interior.

Life History.—If an ergot grain be placed in a moist place the sclerotium of the parasite germinates, producing outgrowths called stromata, with knob-like swellings at their distal ends. This growth is the perfect parasite, and is called *Claviceps purpurea*. If one of the knob-like heads be cut through longitudinally and examined under the microscope, it presents the appearance shown in fig. 3. A large number of oval-shaped bodies called perithecia are seen arranged round its outer surface. Each perithecium contains many long-shaped structures, each of which is in turn packed with eight to ten needle-like spores or sporidia. When ripe, these sporidia escape into the air and become attached to the pistil of a flower of rye. In course of time they germinate to form a sclerotium or ergot.



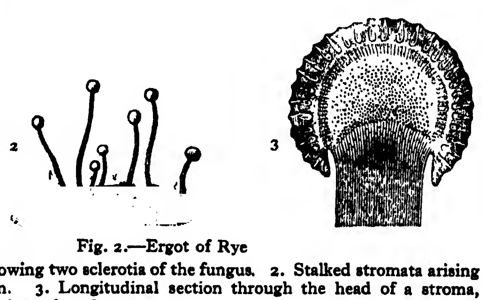


Fig. 2.—Ergot of Rye

1. Ear of rye, showing two sclerotia of the fungus. 2. Stalked stromata arising from the sclerotium. 3. Longitudinal section through the head of a stroma, showing the perithecia at the edge.

If ergotized rye be ground and made into bread, it may give rise to ergotism in those who consume it. Persons thus affected generally suffer

from vomiting and diarrhœa, which may be followed by loss of sensibility, gangrene, or paralysis. This disease is seldom or never seen in this country. Ergot is made into a drug, and being much sought after for this purpose is rarely found in flour.

(*d*) Rust, or *Puccinia graminis.*—This parasite may attack wheat. Fig. 5 shows the microscopical appearance presented by a section through part of a grain of wheat affected by it. The club-shaped teleutospores are seen growing from the surface of the grain. It is questionable whether or not the consumption of this parasite is injurious to health.

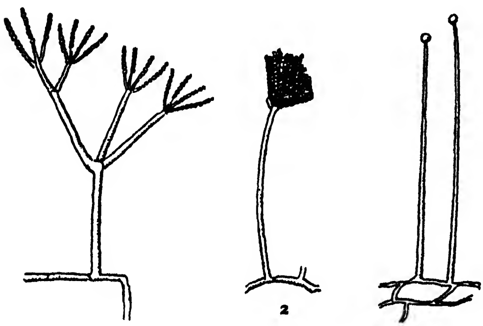


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Fig. 4.—Moulds
1. *Penicillium glaucum.* 2. *Aspergillus glaucus.*
3. *Mucor mucedo.*

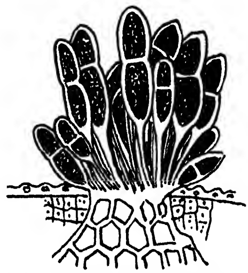


Fig. 5.—Grain of wheat affected with *Puccinia*

(*e*) The Moulds, *Penicillium glaucum*, *Aspergillus glaucus*, and *Mucor mucedo*, may all be found as a greenish growth on damp grain, flour, bread, cheese, &c. Their microscopical appearances are shown in fig. 4.

Animal Parasites.

Meal Mite (*Acarus farinæ*).
Corn Weevil (*Calandra granaria*).
Pea Bruchus (*Bruchus pisi*).
Ear Cockle (*Vibrio tritici*).

Acarus farinæ is occasionally found in inferior meal or flour, especially if it be damp. The presence of acari may be taken as an indication that the flour is commencing to go wrong. *Calandra granaria* destroys the grain by eating the contents and leaving the shell. *Bruchus pisi*, as its name implies, is associated with peas.

Vibrio tritici renders the grain useless, by filling it with a cotton-like substance.

SUGAR

There are two chief varieties of sugar, the one made from sugar cane, the other from beetroot.

Cane Sugar.—The sugar cane is grown in most tropical and sub-tropical countries, but in this country cane sugar is obtained from British possessions. The canes are crushed between rollers until all juice is extracted; this is then filtered and evaporated down and is known as " raw " sugar. Raw sugars are brown in colour and are known as Barbadoes, Demerara, or Mauritius, according to the place and process of manufacture. Brown sugar is refined by remelting, filtering, and passing through tall cylinders of charcoal. The resulting liquid is then evaporated in vacuo, whereby it can be boiled at a low temperature in order to drive off water; if boiled at ordinary temperature it would caramelize, and not crystallize. The crystals formed are collected and packed in bags, and the residue forms treacle or syrup. Sugar contaminated by dirt should be condemned, but adulteration is uncommon.

A sugar mite is found in many brown sugars and is responsible for a skin affection known as " grocer's itch ".

Beet Sugar.—The sugar beet is grown in England as well as many other countries, and in recent years manufacture of English beet sugar has become one of the home industries. The beets are reduced to pulp, all juice is extracted and refined through charcoal as in the case of cane sugar.

NON-ALCOHOLIC BEVERAGES

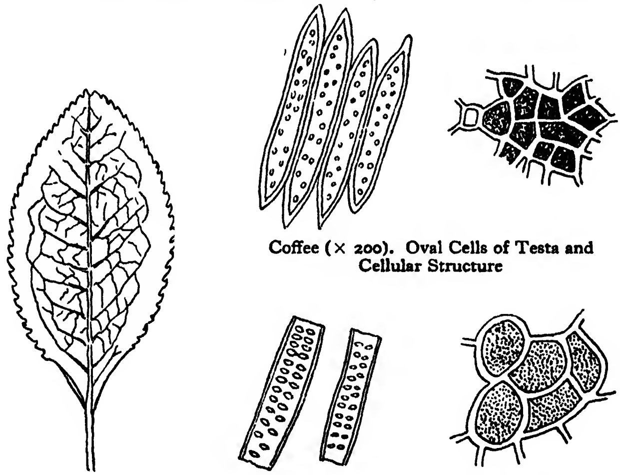
Tea

The dried leaves of the *Camellia thea* plant constitute tea. There are many varieties of the tea plant, but the leaves in use in this country are obtained from the plants of India, Ceylon, China, and Japan.

The tea plant sends out shoots four times a year, and the leaves are picked while the shoots are young; the top bud and first leaf form Orange Pekoe, the next leaf Pekoe, and the next Souchong tea. The flavour of tea varies according to the country of origin, that from China and Japan being finer and less bitter, while that from India and Ceylon is stronger and more bitter to taste.

Tea is of two kinds, green and black; in the former the leaves are dried by heating in hot pans, and are then rolled; while in the latter the leaves are stacked in heaps for about 12 hours until they ferment, when they are rolled and dried over charcoal fires. Green tea is now seldom seen in this country.

Many blends of tea are sold, and as the size of the leaves of the various teas differs considerably, they are all milled to the same size and mixed in a revolving machine. Were this not done the various sized leaves would separate out and not remain blended. Adulteration of tea is practically unheard of consequent upon the passing of the Food and Drugs Acts; prior to this, leaves of plants



Coffee (× 200). Oval Cells of Testa and Cellular Structure

Tea Leaf (magnified) Chicory Dotted Ducts and Cellular Structure

Fig. 6

resembling those of tea, such as the willow and sloe, were sometimes dried and rolled and sold as tea. " Lie tea " consisted of tea leaves which had been infused and, after being dried, &c., were resold as tea. Colouring matters were added to improve the colour of black or green teas.

Insects are rarely met with in tea nowadays as picking and packing are so carefully supervised.

All imported tea is examined at the docks by the Customs officers, and any which has become damp from sea or rain water is rejected. Strong-flavoured substances such as paraffin, onions, cheese, soap, &c., are apt to impart their taste to tea if in contact with it; tea, therefore, should never be stored near any such article.

Coffee

Coffee is derived from the fruit, or berry, of the *Caffea Arabica* plant, which grows in most tropical countries, but mainly in Arabia, Abyssinia, Ceylon, the West Indies, and Brazil. The coffee bean is in two halves contained within a husk; it is dried, the husk removed, and the beans are roasted, ground, and infused in boiling water.

Adulteration of coffee by the addition of chicory was formerly common, but as it is now necessary to declare by word of mouth and in writing that chicory is contained, fraudulent admixture is rarely resorted to. Chicory is the root of a plant of the dandelion tribe, which is grown in England and Belgium. The tubers are dug up, cut into pieces, thoroughly dried, and thereafter roasted and ground. Chicory resembles coffee in appearance, but if thrown into water it sinks and discolours the water, whereas coffee grounds float on the surface and part with none of their colouring matter. The grounds of the two plants can be distinguished from one another by examination under the microscope.

Acorn beans, &c., were formerly roasted ground, and mixed with coffee, but since the passing of the Food and Drugs Acts the penalties imposed made such adulteration unprofitable.

Cocoa

Cocoa is the powdered seed of the fruit of the cocoa plant, *Theobroma cacao*. The seeds, or cocoa nibs, are roasted and thereafter rolled between hot rollers, the contained fat being largely got rid of by this procedure. The cocoa powder is the product which results from prolonged rolling and drying. Chocolate is a mixture of cocoa powder, sugar, starch, and some such flavouring substance as vanilla. Cocoa and chocolate should not be exposed to the rays of the sun, as this will cause them to lose their flavour and colour. Adulteration is practically never met with.

ALCOHOLIC BEVERAGES

Spirits are obtained by the fermentation of various saccharine substances, the alcohol and other volatile bodies produced being separated by distillation. " Proof spirit " is a mixture (57 per cent by volume) of alcohol and water. The strength of distilled spirits is usually expressed in this country in terms of proof spirit. Thus a spirit is either under or over proof, according to whether it contains less or more than does this standard. The common spirits sold in Britain are: whisky, brandy, rum, and gin. All contain ethyl alcohol and water. They may also contain other alcohols, various compound ethers, and aromatic bodies which give to each its characteristic flavour and aroma.

Whisky.—There are two kinds of whisky, namely, malt whisky and grain whisky; the former is distilled in a pot-still and the latter in a patent-still. Scotch malt whisky is prepared from malted barley which is first carefully dried. Some of the characteristic flavour of certain Highland whiskies is believed to be derived from the smoke of the peat which is used as fuel in this process. After being dried, the malt is made into a " mash " with water and subjected to the action of fermentation. When the latter process is completed, the fermented mash, or " wash ", is distilled in a pot-still heated over an open flame. The pot-still is made of copper, and as distillation is effected in a simple worm the spirit is not separated from the by-products of fermentation. When new, pot-still whisky is raw, harsh, and " fiery ", but mellows when kept in wood for some years. Irish pot-still whisky is manufactured in a similar manner to Scotch, but is usually prepared from a mixture of malted barley and unmalted barley or maize, and the malt is not dried over peat.

Grain whisky is made from a mixture of grains—usually barley, rye, and maize—with just sufficient malt to convert their starch into sugar. It is distilled by steam in a patent-still so designed that the fuel oil and the by-products of fermentation are, in large measure, separated from the ethyl alcohol. The result is that it is not so dependent on prolonged keeping as pot-still whisky, and is sooner ready to go into consumption. Its yellow colour is acquired from storage in old sherry casks. Many commercial whiskies are a blend of malt and grain whiskies.

Brandy.—True brandy is distilled from wine. The distillate is at first colourless and of a " fiery " character, but mellows when kept in a cask and becomes coloured from the wood. After prolonged keeping it contains considerable quantities of aldehydes and volatile ethers which

possess valuable therapeutic properties. Many so-called brandies are composed of grain spirit suitably flavoured and coloured. Such substitutes for the genuine article possess little therapeutic value.

Rum is distilled from fermented molasses or from the fermented juice of the sugar cane.

Gin is obtained by the distillation of fermented rye and malt. It is distilled and redistilled, juniper berries, salt, and sometimes hops being added to the final distillate.

Under the Food and Drugs (Adulteration) Act, 1928, whisky, brandy, rum, and gin must not be more than 35 degrees under proof.

Beer used to be made from malt and hops only. At the present day, however, glucose and invert sugar are sometimes used instead of malt, and various vegetable bitters, such as quassia, are frequently substituted for hops. Thus beer may now be defined as—a fermented saccharine infusion to which a wholesome bitter has been added. Glucose and invert sugars are generally obtained by the action of sulphuric acid on rice or other starches. Commercial sulphuric acid contains a considerable amount of arsenic. This fact was responsible for an outbreak of arsenical poisoning among beer drinkers in England in 1900–1. Arsenic may also occur in beer owing to the use of arsenical fuel in the drying of the malt and hops.

The best beers are still made from malt and hops, and are prepared as follows. The barley is moistened and kept in a warm place till it begins to germinate. During this process the ferment " diastase " is developed. It acts upon the starch of the grain, converting some of it into sugar. All further germination is then arrested by drying the barley over a kiln, thus converting it into " malt ". The malt is next subjected to " mashing ", by being crushed and then placed in a mash tub with warm water at about 160° F. During this process the diastase acts further upon the starch, converting most of it into the sugar maltose. This infusion or " wort ", after being clarified, is boiled with hops. It is then cooled to a suitable temperature for fermentation and run into a fermenting tun, where a sufficient quantity of yeast is added. By the action of the latter the sugar splits up into alcohol, which remains in the beer, and carbonic acid gas, which for the most part escapes into the air.

Stout, or **Porter,** is made in the same way as beer, but the malt is first roasted in cylinders and this imparts the dark colour to the beverage. English beer and stout generally contain from 4 to 6 per cent by volume of alcohol and a similar percentage of extract.

Wine may be defined as " the fermented juice of the grape, with such additions only as are essential to the stability or keeping qualities of the wine ".

When the juice of the grape is kept at a moderate temperature fermentation takes place. This fermentation is produced by yeasts, which adhere to the skin of the grapes, and are introduced into the " must "

or grape juice on pressing the grapes. As a result of fermentation the sugar of the juice is converted into alcohol.

Wines vary much in composition. The lighter wines, Bordeaux, Rhine wines, Burgundies, Champagnes, and Moselles, generally contain from 10 to 15 per cent of alcohol by volume. The stronger wines, Sherry, Port, and Madeira, may contain from 15 to 25 per cent of alcohol. Apart from alcohol, wines also contain compound ethers (which are responsible for the bouquet of wine), albuminous and colouring matters, and vegetable acids, such as tannic acid, &c.

To increase the dryness and improve the keeping quality of wines resort is sometimes had to "plastering". In the process sulphate of lime is added to the wine, which assists clarification, but, as potassium sulphate tends to be formed, which in excess might be harmful, not more than 2 grammes per litre is permitted in France. Wines are sometimes pasteurized, which is stated to prolong the life of the wine and to import a flavour only attained otherwise by age. Artificial wine may be made from dried raisins, &c.

Cider is the juice expressed from the pulp of mellowed apples. It contains from 3 to 8 per cent of alcohol. Perry is made in like manner from pears. On account of their acidity cider and perry may have a solvent action on lead, and have occasionally given rise to symptoms of lead poisoning.

Under the Public Health (Preservatives, &c., in Food) Regulations, 1925, the only preservative allowed in beer, cider, and wine is sulphur dioxide not exceeding 10, 200, and 450 parts per million respectively.

CHAPTER IV

Vegetables and Fruit

Vegetables: Colouring of Peas—Preservation of Vegetables.
Fruit: Preservation of Fruit — Worms and Maggots in Fruit — Cystallized Fruits—Refrigeration of Fruit—Carbon Dioxide in Preservation of Fruit.

VEGETABLES

Vegetables should always be supplied to customers in as fresh a condition as possible; indeed, it may be said that it is only those having kitchen gardens of their own who enjoy them in their full perfection. When vegetables become dry, soft, and withered-looking, it is a sign that they are old.

Great care must be taken that lettuces, radishes, cress, celery, and other vegetables commonly eaten raw, be not exposed to contamination of any kind. The writer knew of a case in which a girl contracted hydatids as a result of eating lettuces contaminated with the eggs of *T. echinococcus*. This points to the fact that dogs (which commonly harbour this parasite) should not be permitted to enter gardens where vegetables are grown, nor, indeed, to come in any way in contact with them. Cases of enteric fever also have been traced to the eating of water-cress grown in or washed with water containing the specific organism of that disease. Thus attention to cleanliness is the great essential in handling and selling vegetables, just as it is in the case of any other foodstuff.

Preservation of Vegetables.—Many vegetables, such as peas, tomatoes, asparagus, &c., are canned. The process of canning vegetables is carried out in a similar manner to that described in connexion with meat. Before canning, peas and other vegetables should always be separated into diffeıent sizes, so that all those in one can may be as nearly uniform in size as possible. This not merely adds to their appearance but facilitates their sterilization,

as, if a large and small pea, for example, be put into the same can, the heat required to sterilize the large pea will overcook and impair the edible qualities of the small one.

Colouring of Peas.—Sulphate of copper was formerly used to colour tinned peas, as they are apt to become a dull greyish yellow colour which detracts from their appearance. But under the Public Health (Preservatives, &c., in Food) Regulations, 1925, copper is one of the metallic colouring matters which may not be added to food. Besides being canned, vegetables are often preserved in glass vessels.

FRUIT

Water enters largely into the composition of fruits, many of which contain 80 per cent or more. The solid matter is made up of cellulose, sugars, gums, organic acids, and mineral matter. The flavour is produced by the sugars and acids, while the aromatic substances (essential oils and compound ethers) impart an agreeable odour.

Different fruits have different characteristics: thus, some have more sugar than others; some contain one organic acid, some another; the chief acid in the apple is malic, in the lemon and orange citric, and in the grape tartaric. Most fruits also possess a carbohydrate called pectin or pectose.

Fruit as an Article of Diet.—Many fruits exert a beneficial influence upon the digestive functions and have a mild laxative effect. When fruit is intended to be eaten raw it should be ripe, free from decay or insect life. Immature and imperfectly ripened fruits are unwholesome, and those infected with the eggs of insects may be the means of introducing such larvæ into the stomach of the consumer.

It is customary to gather many kinds of fruit before they are quite ripe, because they carry better in that condition. This is done in the case of apples, pears, plums, bananas, oranges, &c.

It is very important that fruit should not be bruised in packing and sorting, as bruised fruit decomposes readily. Cherries and strawberries are easily bruised, and are, in consequence, not infrequently offered for sale in a decomposed or fermented condition. It is no unusual sight to see strawberries exposed to the sun in a shop window or on a hawker's barrow in a far-advanced stage of putrefaction.

Diseased or decayed fruit may be recognized by softening,

change of colour, and external mould. The grub of the codlin moth (a small caterpillar with a brown head and a pale-pink body marked with black lines and spots) causes much damage to apples and pears by eating its way into the centre of the fruit. The rounded black spots which sometimes appear on the outside of apples and pears are of a fungoid nature, and decrease the value of the fruit.

A condition known as " Brown Heart " is frequently seen in apples, mainly in those from Australia and New Zealand. The

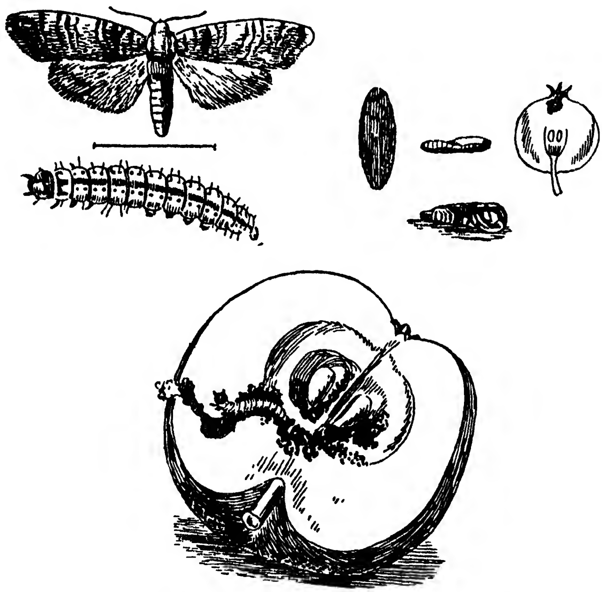


Fig. 7.—Codlin Moth and Grub (*Carpocapsa pomonella*)

condition is difficult to detect from external inspection, but on cutting the apples in halves a softening of the fruit accompanied by brown discolouration is found, spreading from the core outwards, until the whole fruit becomes quite soft. The cause has been found to be an excess of carbonic acid gas.

A brown discolouration of a different kind is known as "scald". It occurs mainly in Canadian and American apples, and begins as a brown discolouration of the skin of the fruit, which at first merely spoils the appearance of the fruit, but gradually spreads into its substance. Protection of apples by wrapping them in waxed paper has met with some degree of success in preventing scald.

Bananas are imported in large quantities; they are picked

green and sent to this country in this state, and are " refined " in rooms at 50° to 60° F. They must be very carefully handled in order to avoid damage, and when exposed to cold winds or frost the skins become blackened. If exposed to excessive cold in the green state the fruit never ripen but remain "green", and when handled have a putty-like soft feeling.

Cocoanuts when in good condition give a clear metallic ring when tapped with a hammer, and should not show any signs of damage at the eyes. Unsound nuts give a dull sound when tapped, and when the shells are broken show a slimy decomposition between the shell and the nut, and the fluid or " milk " contained is sour instead of sweet flavoured.

The solid part of the cocoanut does not spoil readily, but keeps well after being removed from the shell. It is now very largely used in the manufacture of cakes and confectionery.

Nuts.—Nuts contain much oil which may become rancid, and for this reason old nuts may be unwholesome. The nut weevil, a little beetle, may damage nuts, especially filberts, by eating its way into their interior when they are young.

Preservation of Fruit.—Fruit is preserved in a variety of ways. Thus there are bottled or canned fruits, dried and evaporated fruits, crystallized fruit, jams, jellies, &c.; while by the aid of refrigeration many fruits are now brought from Australia, South Africa, and other distant countries.

Bottled or Canned Fruits.—A large and increasing quantity of fruit, such as gooseberries, strawberries, plums, raspberries, currants, peaches, pears, &c., is bottled in Britain every year for winter use. Such fruits, often called " tart fruits ", are as a rule preserved without sugar in a manner similar to that employed in the preservation of meat in glass vessels (see p. 314). It is the custom of certain wholesale dealers in this country to transfer such fruits as peaches, apricots, &c., from tins to glass vessels and to sell them as bottled fruits. The consumer frequently pays more for bottled fruits, believing that the danger which may arise from the action of the acid juices of the fruit upon the metal of the can may thereby be avoided.

Large quantities of canned fruit are imported into Britain from California and other countries. With the exception of the danger which may arise from metallic contamination referred to on p. 313, the mass of such fruit is in every way excellent, and forms an important addition to our diet.

Dried Fruit.—Dried fruit includes raisins, currants, prunes, dates, figs, &c. There are several varieties of raisins: Muscatel raisins, often used as a dessert fruit; and Valencia and Sultana raisins, used for making puddings, &c. Currants are prepared from a small black grape. Raisins and currants should always be kept dry, for if they become damp they are liable to ferment. Dried or evaporated apples and apricots come from the U.S.A. The only preservative allowed in such fruits is sulphur dioxide and it must not exceed 2000 parts per million. (See p. 467.)

Worms are frequently seen in consignments of Australian currants; the moths lay their eggs on the fruit, and during the six-week voyage to this country these hatch out, as the moth eggs withstand both tropical heat and low temperatures of the cold store. Dried figs are difficult to preserve free from maggots and worms. The best figs are obtained from Turkey in Asia, where flies abound during the season when drying of the fruit is being undertaken. Raisins are liable to worms and maggots, but the variety known as sultanas are generally free of these pests, because they undergo a special process of preparation. Sultana raisins are dipped into a boiling alkaline solution which cracks their waterproof coverings and allows drying of the fruit. The boiling solution kills all insect life. Dried plums and prunes are liable to become very dry and unpalatable when stored; they are frequently steamed in order to "refresh" them, and need not be condemned by the inspector on that account.

Crystallized Fruit comes largely from abroad, though a small quantity is made in this country. It consists of fruit which has been boiled in syrup and allowed to dry, when the sugar forms crystals within and on the surface. The only preservative allowed in crystallized fruit is sulphur dioxide, and the quantity must not exceed 100 parts per million.

Jams and Jellies.—Jam consists of fruit boiled with an equal quantity of sugar till it "sets", when it is put into bottles or jars and covered with paper or glass covers. Jelly is prepared much in the same manner as jam, and when sufficiently boiled the product is put through a strainer which removes the solid parts (seeds, skins, &c.), and the jelly is put into jars and sealed.

The only preservative allowed in jam, jelly (prepared as jam is prepared) and marmalade is sulphur dioxide, which must not exceed 40 parts per million. (See p. 467.)

Refrigeration is made use of in bringing fruit from abroad, thus rendering the fruit supplies of many of our colonies available

for the home consumer. Great care is required in finding out the exact temperature best suited for the preservation of any particular fruit. Some fruits can be reduced to a very much lower temperature than others without detriment.

Gas Storage of Fruit.—The use of carbon dioxide gas in connexion with the cold storage of fruit has been reported upon by the Department of Scientific and Industrial Research. In their Special Report No. 30 on Gas Storage of Fruit, it is stated that "in so far as it is a record of experiments and of carefully controlled storage trials, it may be regarded as opening up for the first time the subject of control of the composition of the storage atmosphere in fruit and vegetable storage".

"While it has been indisputably shown that an artificial atmosphere containing less oxygen and more carbon dioxide than is present in normal air retards the natural ripening process of certain varieties of apples, no general claims beyond the limits of the experiments actually described are put forward, and no recommendations are made. . . . But there is no doubt that the subject is one which will repay further and wider investigation." *

The results with Bramley's Seedlings, an apple which is peculiarly liable to injury at low temperatures, have been singularly successful, the optimum temperature being 40° F. and gas mixture containing 10 per cent of oxygen and 10 per cent of carbon dioxide appearing to be most suitable. Later experiments with Cox's pippin have proved successful, but all apples do not lend themselves to the same treatment, and the proportion of carbon dioxide gas and the temperature which suit one variety may be deleterious to another. The experiments seem to prove, however, that preservation by means of gas in suitable proportions, and at suitable temperature, gives better results than cold storage alone.

The difficulties of maintaining a standard of concentration of gas are gone into on p. 299, and the need for prevention of leakage from the cold store. Experiments continue to be undertaken both with fruit and vegetables, and in time the process may become practical both for home storage and for transportation purposes.

Marking and Grading of Fruit and Vegetables.

Under the Agricultural Produce (Grading and Marking) Act, 1928, schemes for the grading of many kinds of vegetables and

* See the latest reports of the Department of Scientific and Industrial Research, for results of the valuable experimental work now in progress.

fruit have been instituted, including potatoes, tomatoes, cucumbers, pears, apples, cherries, plums, strawberries, gooseberries, currants, raspberries, loganberries, and canned fruit and vegetables. Under these schemes vegetables and fruits are graded according to size and condition, and are packed in special types of receptacles in definite weights and quantities.

Section VI.—Preservation and Storage of Meat and other Foods—their Inspection—Causes of Unwholesomeness in Food

CHAPTER I

Preservation and Storage of Meat

Preservation by Means of Salt and other Preservatives—" Pumping " Meats—Preservation and Storage of Meat in Cold Stores—Frozen Meat—Chilled Meat—Carton System of Freezing—Gas Storage of Foodstuffs—Inspection of Imported Meat.

PRESERVATION BY MEANS OF SALT AND OTHER PRESERVATIVES

There are two methods by which meat may be preserved by salt —salting and pickling.

In salting, the salt, or a mixture of salt and other preservatives, is rubbed into the meat in a dry condition; whereas in pickling the meat is immersed in a solution of salt or brine.

In both methods a process of osmosis goes on; the crystalloid applied externally, either in solid or liquid form, diffuses slowly into the interior of the meat, while some of the soluble albuminous matter passes out.

Pumping.—As the process of osmosis progresses slowly, it is customary in many places to " pump " the meat, as it is termed. For this purpose brine pumps, fitted with long hollow needles, are employed to inject the brine into the fleshy parts of the meat, and thus to impregnate it uniformly with the preservative solution. By this means the preservative is at once brought into operation, not merely on the exterior, but all through the interstices of the meat. There seems to be considerable difference of opinion in the trade as to the advisability of pumping meats.

Pickling.—All meats intended for pickling must be thoroughly cooled; the least trace of animal heat lurking near the bone may be sufficient to induce putrefaction. Pickling is generally carried out in tubs made of oak, with perforated lids inside for weighing down whatever is being pickled. Tanks made of slate slabs bolted together

are sometimes employed, and make easily cleaned and convenient pickling vats. Concrete vats rendered smooth on the inside are utilized in pickling factories.

PICKLE.—Nearly every packer has his own particular recipe. Salt, sugar, and saltpetre generally enter into the composition of the pickle. Salt checks the activity and multiplication of micro-organisms, especially those of putrefaction, though it seems to have little effect upon disease-producing germs, and the old idea that pickling renders the meat of diseased animals harmless is no longer tenable. Sugar is generally added on account of its action in preventing putrefaction and counteracting the harshness imparted to meats by saltpetre, which is useful as a preservative and gives a pleasing colour to the meat.

For determining the exact solid content of the brine a "salinometer", constructed on the principle of a hydrometer, is employed.

All pickles lose strength when fresh meat is immersed in them; thus a pickle of, say, 85° may, in ten days after being put into the cask along with fresh meat, register as low as 73° when tested with the salinometer. Pickle thus reduced in strength must never be left in contact with meat for any length of time after it is fully cured, otherwise the meat becomes "pickle-soaked" and the pickle turns sour.

A large quantity of hams and bacon are imported into this country from abroad in what is known as the "green" state; that is, they have been subjected to a preliminary process of pickling, but have not been fully cured, smoked, or otherwise prepared for sale. Such hams, &c., are used by ham and bacon curers in this country, who hang, smoke, and finish them according to local requirements of the trade.

MILD CURED MEATS.—The demand for what are known as mild cured, i.e. comparatively saltless, hams and bacon is great. In their preparation the temperature of the packing and storage rooms, brine, &c., requires to be carefully regulated. Thus the temperature of the apartment where pickling is carried on should be about 40° F., and must never be allowed to become too warm, otherwise the pickle is liable to become "ropy", when the meat cured in it will present an uninviting appearance.

TIME OCCUPIED IN CURING.—The time taken by meats to cure will depend upon: (*a*) the strength of the brine, (*b*) the total weight of meat in the pickling vat, (*c*) the weight of the individual pieces of meat.

When meat is pickled in barrels it is customary to roll them frequently, in order to facilitate the cure.

Mild cured meats are not intended to be kept long after being cured, but should be used as soon afterwards as practicable.

PREMISES.—The premises where pickling is carried on should, of course, be kept scrupulously clean, and to facilitate this the floors and walls ought to be made of some hard impervious material, the former being laid with a gentle slope towards a gutter, so that should any cask leak it may be readily seen and located. All tierces (casks used for pickling meats), barrels, or kegs, after being used, should be thoroughly washed and aired before being used again.

Salting.—In salting by the "dry method" a mixture of salt, sugar, saltpetre, and sometimes black pepper, is rubbed well into the meat, no water being used.

In curing bacon by this method the sides are very often "pumped" to begin with. They are then laid rind downwards, and are covered lightly with fine saltpetre. On the top of this is laid a heavy layer of salt, and the sides are "stacked" one on top of the other. These stacks are left undisturbed for ten to twelve days, until the cure is completed; then, if the bacon is to be unsmoked, it is drained, washed, trimmed, and dispatched. If, on the other hand, it is to be smoked, as is most bacon in Britain, it is drained for seven to ten days, and is then washed, wiped, and trimmed, after which it is dusted over with pea meal and hung in the smoke for three to four days at a temperature of 85° F.

Inspection of Pickled and Salted Meat.—It is difficult to judge of the quality of pickled or salted meat by inspection. Once it has been cooked its quality is much more easily ascertained. If partially decomposed flesh is salted or pickled, it will be found softer than normal, and may possess a putrefactive odour or greenish colour. If the salting or pickling has been improperly carried out the meat is generally paler than it should be, and of a slimy consistence. As putrefaction frequently commences near the bone, it is advisable, where taint is suspected, to thrust a "trier" or the blade of a knife into the meat, and to smell it on withdrawal for any odour of taint. Old salt meat may be recognized by its extreme hardness, toughness, and shrivelled appearance.

Smoking.—This process is carried out in chambers or stoves built of brick, and provided with a good ventilator in the centre of the roof for the purpose of drawing up the smoke through the material being smoked. There should also be a number of other

ventilators at intervals, by the opening and closing of which the temperature of the interior may be regulated. Iron bars, from which the meat hangs while being smoked, should stretch across the stove and be built into the walls on either side. The floor of the stove should be made of concrete. An iron door, fitted with a sliding panel near its bottom for the admission of air and regulation of the draught, is also necessary.

While in use the temperature of the stove should never be allowed to exceed 84° F. If it rises higher than this the meat will become overheated, will assume a dull colour when cool, will never regain its original firmness of texture, and will in every way be unsatisfactory.

Properly smoked meats should be firm and bright in colour.

PRESERVATION AND STORAGE OF MEAT IN COLD STORES

The action of cold is now extensively used for the preservation of perishable foods. Cold does not kill micro-organisms, but merely renders them inactive. When food is reduced to a low temperature, the action of the putrefactive organisms, which would otherwise cause it to go wrong in the course of a few days, is arrested, so that the food may be kept for an almost indefinite period, provided the temperature be maintained sufficiently low.

There are four different processes which should be carefully distinguished:

(*a*) " A certain amount of meat is imported into this country in a completely frozen condition. This meat is carried at a temperature of from 15° to 16° Fahrenheit, and is known to the trade as ' frozen ' meat.

(*b*) " The bulk of our meat supplies are imported at a temperature slightly below freezing-point, the lowest permissible temperature specified for this purpose in the contracts between the importers and the shipping companies being 29°." (This meat is known to the trade as " chilled " meat.)

(*c*) " Home-killed meat in this country is quite frequently held in a mechanically refrigerated store at a temperature of between 36° and 45°. For such a process no particular name is in general use.

(*d*) " All meat is hung for some hours after slaughter in a room at air temperature till the body heat has disappeared. This process

is generally known as cooling or precooling and the room in which it takes place as the cooling room." [1]

The use of cold is by no means restricted to the preservation of meat; advantage is also taken of it in many other directions. Butter is brought from Australia, Canada, and other places; eggs can be successfully stored for many months in cold-rooms, and fresh fruits, fish, game, and poultry can be preserved. In this connexion the large number of frozen rabbits now imported into this country from Australia must be mentioned.

In recent years refrigeration has been applied to the preservation of milk, the ripening of cheese, and to many other purposes.

Refrigerating Machinery.—It would not be practicable to go into detail with regard to the construction of refrigerating machinery. A few essential features, sufficient to explain the principle on which they work, may, however, be given.

When a volatile liquid evaporates into the gaseous state it absorbs in the process a certain quantity of heat, which is thereby rendered latent, or insensible to the thermometer. This heat is derived from the atmosphere or any other warm body with which the volatile liquid happened to be in contact. Thus, if a little ether is poured on the hand, it evaporates rapidly, leaving a sense of cold, as it abstracts from the hand some of the heat necessary for its evaporation.

Suppose that some ether were placed in a coil of pipe immersed in brine. The heat necessary for its evaporation would be derived chiefly from the brine. If the ether vapour were withdrawn by a pump attached to one end of the pipe, and a partial vacuum were produced thereby in the coil, the evaporation process would be hastened and the refrigerating effect correspondingly increased. It would be wasteful to pump the ether vapour into the atmosphere, therefore some method has to be devised to prevent such loss. This is accomplished by pumping and compressing the ether vapour in another coil of pipe attached to the exit side of the pump.

The compression of the vapour makes it assume the liquid form once more, and at the same time part with the latent heat which it previously absorbed during its evaporation. This latent heat is got rid of by immersing the compression coil in cold water. The liquid ether is returned to the evaporation coil by a suitable pipe, and the processes of evaporation and condensation go on continuously. The refrigerants most commonly used to produce low temperatures for cold storage are ammonia, sulphur dioxide, carbon dioxide, ethyl and methyl chloride, and sometimes ether.

A refrigerating plant is made up of three essential parts—compressor, evaporator, and condenser.

[1] *Report of the Committee of the Economic Advisory Council on the Slaughtering of Livestock*, 1933.

THE COMPRESSOR is a specialized form of pump suitably designed for the particular refrigerant used. The suction end is connected with the evaporator, in which it produces a partial vacuum, thereby greatly accelerating the speed with which the volatile liquid evaporates. The delivery end is connected with the condenser, in which the process is reversed.

THE EVAPORATOR consists of a coil of iron or copper piping ½ in. to 2 in. in diameter, inside which the refrigerant is placed. One end of this coil of pipe is connected with the suction side of the compressor, and the other is suitably connected with the exit end of the condenser.

THE CONDENSER is a similar coil of piping attached to the compression side of the compressor, and is immersed in a tank of constantly circulating cold water.

There are several different methods by which cold may be applied.

1. By direct expansion, where the evaporator is placed in the space that it is desired to cool.

2. Where the evaporator is fitted up in a tank containing brine (which cannot freeze). After being cooled, the brine is circulated through pipes or " brine drums " in the space that is to be cooled.

3. Air cooling is also made use of. In this system the air of the space to be cooled is circulated by means of fans either over the evaporator, or over coils of pipe containing cold brine, or is brought into direct contact with the cold brine itself.

Meat may be preserved either by freezing or chilling.

Frozen Meat.—Meat that has to be conveyed long distances by sea is generally frozen. Each carcass is placed in a chilling room as soon after dressing as possible, and the temperature of the chamber cooled down to the requisite degree after the carcasses have been " loaded ". The carcasses are quartered after a period of about 36 hours, and are thereafter frozen in the cold chamber. They are then placed on board ship, for transport, where they are maintained at a temperature of about 15°–16° F. Australia, New Zealand, and the Argentine export to this country frozen beef, mutton, and lamb.

In the process of freezing, the fluid constituents of the meat expand, causing a rupture of the cells of the animal's body, with the result that the hæmoglobin of the blood permeates the tissues, giving to the meat a diffuse red or pink colour. On being thawed the surface of the carcass becomes moist, and drops of liquid fall to the ground. This moisture is probably partly derived from fluids which exude from the tissues, but must also be accounted for by condensation of aqueous vapour of the surrounding warmer air upon the cold surfaces of the meat. When thoroughly thawed the surface

becomes dry and dirty-looking; if cut into, however, the meat still looks moist. The fat of frozen meat is always very white.

Putrefactive and pathogenic bacteria are not killed by low temperatures, though inhibited in their action, and remain in a dormant condition in frozen carcasses. When frozen meat is thawed, however, putrefaction rapidly sets in, especially in foggy weather, when it has to be very carefully watched.

Signs of commencing putrefaction may often be detected by cutting into the hip-joint, where this process generally commences. The condition is known as "bone taint". (See p. 293.)

Mutton is nearly always imported in the frozen state, the carcasses being piled one on the other in the ship's hold. Much more

CHARACTERISTICS OF REFRIGERATED MEAT

	Surface	Flesh	Fat	Vertebræ	Spinal Cord [1]	Shrinkage
Home-killed beef.	Cold, dry characteristic sheen on fascia.	Good red colour	Yellowish white.	Chopped through unless very old.	May be present.	Little or none.
Chilled beef.	Cold, damp, sweaty, no sheen.	Pink colour.	Pinkish white	Sawn through.	Absent.	Considerable.
Frozen meat.	Cold, moist, drips when thawing. No sheen.	Pale red.	Dead white.	Sawn through.	Absent.	Considerable.

space would be required if the carcasses were hung singly in a chilling chamber. Frozen mutton may be recognized by the flattened condition of the cod-fat from pressure of the superimposed carcasses, and also by the moisture which exudes during thawing. Pork, like mutton, is imported in the frozen state.

Chilled Meat is the term applied to meat that has merely been chilled and not frozen, by being subjected to a temperature of 29° F. If such meat reaches the consumer within 40 days of the date on which the animal was slaughtered, it is generally found to be in good condition. In the country of origin, the dressed carcasses are placed in the cold chamber, and, as soon as sufficient carcasses to fill the store have been loaded, the air, which has become raised in temperature during the process of loading, is cooled down to the requisite degree. After about 36 hours the carcasses are graded,

[1] The spinal column may be partially sawn in home-killed beef.

quartered, the meat weighed, and covered with stockinette or hessian. The chamber is then closed, the meat being ready for transport. Chilled meat quickly putrefies, especially in warm weather; butchers therefore, wherever possible, leave it in refrigerating chambers till actually required for use. Such flesh on section is found to be pink; the fat is tinted in a similar manner, due to the escape of meat juice. The external surface of the carcass is cold, damp, and sweaty.

Mutton is imported in small quantities in the chilled state, and is generally re-exported to France, where it finds a ready market, notwithstanding its high cost.

CARTON SYSTEM OF FREEZING

A quick freezing system known as the " carton system " has proved successful for the preservation of small joints of meat. The process is as follows: the meat is prepared for cooking, being cut up into small joints or portions, and all excessive fat and gristle removed. It is then wrapped in cellulose paper (or other fluid resisting material) and packed into perforated boxes. The boxes are acted upon by the freezing fluid, which escapes under pressure in the form of a fine spray from small holes in the pipes containing the freezing mixture. The temperature must be maintained very low, and the meat becomes frozen within 20 minutes. When removed from the paper wrapping, the meat can be cooked immediately, as the ice particles contained are so minute that they thaw out at once. The flavour of the meat is said to be equal to that of home-killed beef.

The process has proved a complete success in America for internal use, but cannot, unfortunately, be considered a sound economic proposition for universal use. The reasons for this are several, namely, the freezing mixture cannot penetrate into thick portions of meat or large joints; only the best parts of a carcass can therefore be used. The carton packets must be kept frozen until required for use owing to the rapidity with which the ice crystals thaw out; this necessitates special refrigerating plant throughout transport. Disposal of the remainder of a carcass from which the choicest portions have been removed is not easy or profitable. Owing to the above conditions the price of meat frozen in cartons would need to be very high in order to cover the cost of production; its introduction into this country on a large scale is therefore unlikely.

GAS STORAGE OF FOODSTUFFS

The Department of Scientific and Industrial Research is at present engaged in investigating the use of gases in the storage of foodstuffs. The research is as yet incomplete, but it is hoped that improvement in

keeping quality may result from the perfection of the process, as it has already been found that the storage of meat and fruit may be markedly assisted in the presence of carbon dioxide gas. Gas storage is really a modification of the chilling process in which the air of the cold stores is impregnated with a certain proportion of CO_2.

Carbon dioxide gas (CO_2) has been successfully used in experiments for the storage of certain fruits (see p. 287). The gas appears to inhibit mould formation and bacterial growth on meat under favourable conditions. Before it can be used as a commercial process, however, several factors will have to be overcome. The strength of the gas requires to be kept constant; leakage must therefore be prevented. This means that storage chambers, including the holds of ships, must be leakage proof, or in other words, specially constructed for the purpose. Further, as meat and fruit give off a certain amount of carbon dioxide gas while in cold store, and absorb a proportion of oxygen, in order to maintain a definite proportion of CO_2 gas in the chamber periodical readjustments of the gas content will be necessary. It would appear that the optimum percentage of CO_2 gas for the preservation of foodstuffs varies with the different kinds of food; mixed consignments could not therefore be carried in the same compartment with success. These and other problems are under investigation, but the results already obtained from the experiments are remarkable and lead us to hope that food storage will be greatly facilitated in the near future.

INSPECTION OF IMPORTED MEAT

"In 1928–29 imported meat accounted for 47 per cent of the beef and veal consumed in Great Britain, 50 per cent of the mutton or lamb, and 58 per cent of the pig meat."[1]

The control of imported food is carried out under the Public Health (Imported Food) Regulations, 1925, and the Public Health (Imported Food) Amendment Regulations, 1933, by Port Sanitary Authorities and the Sanitary Authorities of districts which abut on any part of a Customs port which is not within the jurisdiction of a Port Sanitary Authority. Provision is made for the inspection of food arriving by ship, train-ferry, or aircraft.

The Medical Officer of Health is empowered to examine any article of food either before or after it is landed, and to require such uncovering or unpacking as may be necessary for his inspection.

If the Customs examination of a consignment of food has not been completed the Medical Officer of Health may not inspect without the consent of the Customs Officer concerned. In practice there is close co-operation between the officers of His Majesty's Customs and of the Port

[1] *Report of the Committee of the Economic Advisory Council on the Slaughtering of Livestock*, 1933.

Sanitary Authority, who frequently conduct their examination together in order to save time and to avoid opening more packages than is reasonably necessary. The Medical Officer of Health may take samples for analysis and detain consignments for such period, not exceeding 48 hours, as may be necessary. Usually importers will agree to the consignment being detained until the report of the analyst is received.

Food which is found to be diseased, unsound, unwholesome or unfit for human consumption may be seized and application made to a Justice for its condemnation, but in nearly every case imported food found to be in such condition is voluntarily surrendered by the importer.

In regard to imported meat it is obvious that the inspector has available only limited, or perhaps even no, evidence as to the condition of the animal from which it is derived, and therefore the Imported Food Regulations prohibit the import of certain classes of meat, and admit others only on condition that they are accompanied by an official certificate issued by a competent authority in the country of origin and recognized by the Ministry of Health as evidence that the meat is derived from an animal which was free from disease at the time of slaughter and was dressed, prepared and packed with all necessary precaution for the prevention of danger to public health.

Broadly speaking, if meat arrives in such condition or in such form that it may be assumed that it is derived from diseased animals or is at least of inferior quality, it is classed as Prohibited Meat and must be exported. Thus scrap meat, i.e. scraps, trimmings, or pieces which cannot be identified with a definite part of the carcass; meat comprising the ribs or abdominal wall from which the pleura or peritoneum have been detached; the carcass or severed part of a carcass of any animal without the associated lymphatic glands in their natural position or the head or tongue without the submaxillary lymphatic gland, are prohibited. Sausages and other prepared or manufactured articles of food are, however, excluded from this category.

If, on the other hand, there is no reason to suspect that the meat is derived from a diseased animal or is of inferior quality, but it would be impossible for an inspector to form a reasonably accurate impression as to the condition, at the time of slaughter, of the animal from which it is derived, then it is required to have an official certificate and is classed as Conditionally Admissible meat. If it has not an official certificate it must be exported, whatever its condition.

This class of meat includes the severed part of a carcass of an animal with the associated lymphatic glands in situ, edible offal and lard, dripping and edible tallow.

The entire carcass of an animal with the head attached and the lymphatic glands in their natural positions is not required to have an official certificate, but imports of this nature are very small, comprising only a certain number of frozen pigs.

Any part of the carcass of a pig which has been salted, cured, pickled, dried or smoked or otherwise prepared in the manner in which bacon or ham is ordinarily prepared is admissible without an official certificate, nor is it dealt with as prohibited meat by reason of the fact that the pleura or peritoneum has been detached.

Certain classes of edible tallow, viz. oleo oil, oleo stearine, and premier jus, are not required to have an official certificate, and this exemption is also extended to sausages and other prepared or manufactured articles of food, and the intestines prepared in the form of sausage casings.

Thus with the exception of bacon and ham practically all imported meat is now included in the " Conditionally Admissible " category. But the affixing of an official certificate in the country of origin does not exempt meat from inspection on arrival. There are conditions, such as mould growths, brine damage, bone taint and decomposition, which may develop during transit, and moreover, it is desirable to check the inspection abroad from time to time.

General Procedure at the Port of Entry.

The Regulations require the Customs Officers to ascertain whether the cargo of a ship comprises any oversea meat. If it appears to the Customs Officer that it is desirable that any oversea meat should be examined by the Medical Officer of Health with a view to ascertaining whether it includes any prohibited meat or any conditionally admissible meat without an official certificate or for any other purpose of the Regulations, he must issue a detention notice to the Master of the ship or the importer of the meat and inform the Medical Officer of Health. This is one way in which the food inspector obtains information, but in practice he does not usually wait for notices from the Customs. Every morning he is supplied with a copy of the day's issue of the Customs Bill of Entry, which gives a list of all ships entering the port during the previous day with details of their cargoes. From this the inspector knows what ships to visit and what foodstuffs to look for. He has another source of information which is accessible more promptly than the Bill of Entry, viz. a copy of the cargo manifest of the ship, which he can always peruse either on board the ship or in the quay-side office of the Shipping Company concerned.

So enormous is the quantity of food imported that it would be impossible to examine as a routine a definite percentage of everything without causing unjustifiable delay and inconvenience to the distribution of the food supplies of the country. In the first place, the principal importers are anxious to comply with the Regulations, and actually assist the inspector in his work. In the second place, the inspector knows by experience what marks have proved consistently satisfactory, and what need his special attention. As he watches the landing of cargo he notes staining of covering materials and cases indicating decomposition or brine damage, loss of contour or alteration in the shape of carcasses indicating softening;

here and there he opens up coverings to look for moulds, brine staining or disease. Thus he is able to form an opinion as to the condition of the consignment as a whole without seriously interfering with the work of discharging the ship. If he finds everything uniformly satisfactory he is content to examine a few samples only; if, on the other hand, he finds evidence of disease or unsoundness he increases the extent of his inspection, and if necessary orders the detention of whole parcels either on the quay or in cold store for full examination. This procedure was adopted during the years 1928 and 1929 in regard to imported mutton because of the extent to which carcasses were affected with Caseous Lymphadenitis. As a result a system of inspection was instituted in the countries of origin, and conditions have so improved that only 5 per cent of carcasses of mutton are now inspected on arrival as a check on the standard of examination abroad. Cuts of mutton are, however, still subjected to a 100 per cent examination here.

When inspection on this scale is necessary serious delay would occur in the distribution of food if all the meat were detained in the Port Sanitary District for examination by the relatively small staff of the Port Sanitary Authority. It is therefore the practice for the importers to arrange with Medical Officers of Health of inland districts in which there is large cold storage accommodation to accept responsibility for the examination on the understanding that the Port Sanitary Authority forwards to such Medical Officers of Health the marks and quantities of each consignment, and that the meat will be held in cold store until released by the Medical Officers of Health concerned. The Port Sanitary Authority undertake the examination of all consignments in regard to which no such special arrangement has been made.

Importers realize that it is in their own interests not only to attain a high standard of examination in their abattoirs abroad, but also to have goods so prepared and packed as to facilitate examination here. Thus ox-tongues arrive dressed so as to have the lymphatic glands easily accessible; pig carcasses have the submaxillary glands incised and drawn forward in an exposed position so that no difficulty is experienced in examining the carcass in the frozen state; imported offal is packed with a view to rapid inspection, and boneless veal has the serous membrane exposed.

It is exceptional to find in imported meat evidence of the diseases which are commonly met with in slaughter-houses in this country. This is partly due to the conditions under which the animals live in the great meat exporting countries, partly to the system of inspection under Government control in those countries, and partly to the trade being in the hands of firms of world-wide repute. From time to time such conditions as Onchocherciasis in Australian beef, Caseous Lymphadenitis in mutton from Australia, South America and New Zealand, and Actinobacillosis in ox-tongues have required vigorous action on the part of

Port Sanitary Authorities. But as soon as the importers have understood the cause of the trouble they have set to work to deal with it at the source, and Port Sanitary Authorities have experienced a quick response to their representations.

Thus it comes about that the meat inspectors in the ports find themselves principally concerned with conditions which arise during transit, moulds, brine staining and decomposition. Moulds are dealt with on p. 323. White mould can be wiped off, but black mould requires trimming of the meat. Inside the thoracic or abdominal cavities trimming is impracticable, elsewhere each case must be decided on its merits as to whether the value of the meat saved will repay the cost of trimming. Brine damage is due to the leakage of brine from the pipes in which it is circulated round the chambers or holds. Not only does this cause a greenish or brown discolouration, but since the brine used is a solution of calcium chloride the taste of the damaged meat is bitter and unpalatable. The affected parts may be trimmed, but again the amount that can be saved depends upon the extent and situation of the damage. Decomposition may be limited, due to faulty stowage, or extensive when there has been a breakdown in the refrigerating plant or there has been some accident to the ship. Bone taint is most likely to be discovered when meat is being sawn up, the smell being then unmistakable. How the causal bacteria gain access to the affected parts is not clear, but probably the large blood-vessels are the portal of entry. Fatigue or injury immediately prior to the slaughter are predisposing factors. But the development of the organisms depends on a favourable temperature in the deeper parts, hence it is most common in the region of the hip-joint and in well-fed animals. For prevention it is essential that the natural body heat should be dispersed as rapidly as possible after the dressing of the carcass.

Fire, water and smoke damage to meat cargoes from time to time require the attention of the inspector. Occasionally meat is affected by emanations from fuel oil, but usually after a week or two in cold storage all trace of this disappears.

A great variety of foodstuffs other than meat come under the notice of the port food inspector, including canned goods, fruit, fresh and dried, dairy produce, seeds, nuts, spices, confectionery, sugar, &c. In a number of instances a Customs examination is carried out, and the food inspector avails himself of this opportunity for inspection. Many importers of canned goods carry out on the quay, as a routine, a 10 per cent examination of all their consignments. The inspector keeps in close touch with these examinations. In addition stained cases suggest blown and leaking tins, necessitating opening of the cases and examination of the tins by the usual methods. Cases crushed in transit or broken during landing provide useful opportunities for sampling consignments, though the inspector is entitled to have opened such packages as he deems necessary. As already stated, it is not practicable to conduct a percentage examina-

tion of everything, but if the inspector keeps his eyes and ears open and takes every convenient opportunity of sampling consignments and of learning from experts who deal in the various food products landed in his district, he is able to exercise very effective control without unnecessary interference.

Very little of the foodstuffs which are condemned as unfit for human consumption is actually destroyed. Nearly everything has some value for industrial purposes, such as the manufacture of soap, lubricants, bone manure, poultry spice, dog biscuits, or for pig and cattle feeding. But in each case the use of such foods must be controlled. Guarantees must be obtained from the actual manufacturers or users, and before the condemned food is released it is necessary to obtain the sanction of the Medical Officer of Health of the district to which it is to be sent, except when such Medical Officer of Health has given a standing approval in respect of certain receivers.

CHAPTER II

Canning of Foods, &c.

Preservation by Means of Heat—Canning—Blowing of Cans—Inspection of Canned Foods—Sausages—Other Meat Products—Inspection of Prepared Foods.

PRESERVATION BY MEANS OF HEAT. CANNING OF FOODS

Foods of many kinds are preserved by sterilizing and enclosing them in hermetically sealed tins or other vessels.

If food be subjected to and maintained at a sufficiently high temperature for a sufficient length of time, the micro-organisms which it contained are destroyed, and if such articles be hermetically sealed in some form of vessel, so as to prevent fresh organisms gaining access to them, they may be kept without spoiling for an almost unlimited time.

Cans in which meat and other foodstuffs are preserved are made of tin plate. The can and lid are made separately, the latter being put on after the can has been packed with the particular food material it is intended to hold. Tins of the " hole and cap " variety are generally employed for the canning of corned meat, while fresh beef, fruit, and vegetables are often put up in cans of the sanitary type. In the case of the former the lids are soldered on after the cans have been filled, while in the latter the lids are fixed by bending round the edges in a machine so as to make an air-tight joint, and usually a paper or rubber solution or gasket is employed to render the joint still more impervious to air.

A general description of the preparation of corned beef as carried out in the factories of North and South America may be given.

1. Pickling of the Meat.—The meat is pickled in a solution of common salt and nitre, to which a small quantity of sugar is sometimes added. In the " cold pickle " process the meat is immersed in the brine in a cold condition, while in the " hot pickle " process

the meat is first put into warm water, the temperature of which is raised to a point short of boiling. The parboiled meat is then placed in the pickling tanks for a few hours, after which it is removed and immersed in boiling water for several minutes in order to remove any excess of pickle which it may contain. The "hot pickle" method is more rapid than the cold, and a certain amount of meat-extract is subsequently recovered from the water used in the par-boiling process.

2. PICKING OVER AND TRIMMING.—The pickled meat is "picked over" and inedible materials, such as aponeurotic tissue, inter-muscular septa, small blood-vessels, pieces of bone, skin, &c., are removed.

3. COOKING AND CAN-FILLING.—The meat is next partially cooked, cut up, and filled into cans by rotary "stuffing" machines, which deliver a definite quantity of meat into each can by means of a "plunger" or piston arrangement. Some firms prepare a meat jelly, which is added to the tins, in liquid form, by a mechanical and automatic device, while the cans are being filled with meat on the rotary "stuffing" machine. This jelly acts as a "binder", and improves the appearance and palatability of the canned article.

4. CAN SEALING, &c.—The lids or "caps" are next soldered on to the cans which contain the meat. In the centre of each lid is a small hole which is, at this stage, loosely covered by a dab of solder. The tins are then fed into a vacuum sealing machine which comprises a chamber connected to a powerful vacuum pump. When the chamber is full of cans and the openings are closed the pump is put into operation until a vacuum of 20 to 25 inches is registered on the gauge. The small central hole in the lid of each can is then soldered up by an ingenious contrivance while the tins are still in the can-sealing apparatus. In this manner a vacuum of 20 to 25 inches is obtained inside the closed tins, and, when removed and inspected, each can should have concave collapsed sides pressed tightly against the contained meat.[1]

[1] In some factories a vacuum sealing machine is not used; instead the cans, after being filled, are passed through an exhaust box consisting of a chamber which is kept full of steam under ordinary pressure. As the cans travel slowly through the chamber, in which they generally remain for some five or six minutes, their contents reach a higher temperature than that of the steam, hence a vacuum is produced. The exhaust box is widely used in connexion with the canning of vegetables and fruit.

When "sanitary" cans are used the requisite vacuum is generally obtained by passing them through a steam exhaust box before they are closed by the double seamer machine.

Resort is sometimes had to another procedure, in which the central hole and cap are soldered in the cold and without the use of a vacuum sealing machine. The tins are then put into retorts and heated by means of current steam. They are then removed, and, while still very hot, the central soldered hole is touched with a hot iron in order to melt the solder and allow the steam and air to escape, when the hole is immediately soldered up again. Quite a good vacuum in the inside of the cans is generally produced in this way.

5. PROCESSING.—It next becomes necessary to sterilize the contents of the cans by subjecting them to heat, either in open tanks or in retorts (autoclaves). The length of time and temperature employed in this process varies in accordance with the size of the cans and the nature of their contents. The heating causes the contents of the cans to expand and their sides to bulge, but, on removal from the tanks or autoclaves, they are rapidly cooled under streams of cold water, when they once more become concave.

6. FINISHING.—The cans are washed in a solution of potash and subsequently in hot water to remove from their exterior any grease or other adherent material. They are then lacquered and labelled, stored for a few days for purposes of observation in order to detect " leaking " cans, and are finally packed in cases ready for shipment.

Careful " testing " of the cans after sterilization is a very important matter. This is effected by storage for a week or more prior to packing the cans in cases. The process is rendered more efficient by incubating the cans during the week in rooms artificially heated to a temperature of 37° C. to 42° C. The cans are then examined, and those that are defective discarded.

In the manufacture of canned goods great importance is attached to the production of a vacuum in the inside of the tins, as it is generally recognized that foods put up with a vacuum keep better than those not exhausted. In considering the object of this procedure, and why it is so universally practised, Dr. Savage states :[1]

" In the first place the canner has learned by experience that a can with concave ends is usually one that will not spoil, and the distributor, retailer, and consumer alike look askance upon any tin which has not this appearance. It is also probable that the heat penetration and so the effectiveness of processing is better in tins from which most of the air has been removed. In the next place the absence or diminution in the quantity of oxygen lessens the activity with which the food attacks the container. This does not apply to meat to any great extent, but is an important point as regards fruit and vegetables. Exhaustion also prevents overfilling, as the contraction on cooling will give sufficient head space. The absence of air may be of importance from another point of view. It has not yet been determined whether bacteria may remain alive but latent in canned foods, being present but unable to grow and produce products of decomposition owing to the conditions being unfavourable to their development. Of such conditions absence of free oxygen is of considerable importance

[1] Department of Scientific and Industrial Research, Food Investigation Board, Special Report No. 3: *The Methods used for the Inspection of Canned Foods and their reliability for this purpose*, by William G. Savage, M.D. Part I, " Canned Meats ".

as affecting the aerobic bacteria. The removal of the air may in this way diminish the amount of spoilage. The commercial canner would not know or appreciate this consideration as such, but he would recognize the broad fact that foods put up with a vacuum keep better than those not exhausted."

BLOWING OR SWELLING OF CANS

Most cans are made of iron plates, but as iron is an unstable metal, the plates are dipped into molten tin, and become coated on each side with a thin layer of the more stable metal. Great care should be taken, when bending the plates to form the can, that the tin does not become cracked, as this leaves the iron uncovered and liable to be acted upon by the contents of the can. The seams of cans are the places where such cracks are most liable to occur. The reports on the " Corrosion of the Tin-plate Container by Food Products ", issued by the Department of Scientific and Industrial Research, contains much valuable information from which the following notes were in large measure derived.

A normal can should have slightly concave ends; the undernoted alterations in the shape of cans may be met with:

(1) Cans dented from accident or injury will show an indentation at one part and a compensating bulge at another.

(2) A can may appear flat, but when one end is tapped the opposite end may bulge; such a can is termed a " flipper ". If the bulged end is pushed back it should remain flat. This condition may result from inefficient sealing, commencing putrefaction, or from the production of a small amount of hydrogen gas in the can.

(3) One end of a can may bulge, and if that end is pushed in, the opposite end will bulge; this is termed a " springer ", and is a further stage of a " flipper ".

(4) Both ends may bulge, when the can is known as a " swell " or " blown " container.

" Blowing " or " Swelling " of cans may be due to one of two main causes: (*a*) bacterial action, or (*b*) corrosion of the metal container.

(*a*) Bacterial Action.—If the contents of the can are not completely sterilized during " processing ", some of the bacteria or their spores may give rise to putrefactive changes, due to bacterial growth, with resultant gas production and swelling of the can.

(*b*) Corrosion of the Metal Container.—" All classes of foodstuffs, whether fish, meat, vegetables, or fruit, tend to attack the iron and tin of which the can is made, and to become contaminated by these metals." Corrosion of the metal container may be responsible for three conditions: (1) formation of pin-holes in the can, (2) discolouration of the can contents, and (3) bulging or blowing of the can.

(1) With regard to the formation of pin-holes, little need be said: such cans will leak and should be condemned.

(2) Discolouration of the can contents: two classes of discolouration are met with, namely, one in which bleaching of the can contents takes place, and the other in which blackening of the can contents occurs either at the sides of the can or penetrating into the centre of the contents.

Fruits such as cherries, blackberries, raspberries, strawberries, &c., contain certain pigments, known as "anthocyanin pigments", which in the presence of tin become bleached. The acid contained in the fruit acts on the tin, and hydrogen gas is given off; this "nascent", or freshly liberated, hydrogen acts on the fruit as a bleaching agent, removing its colour, and leaving it pale and unattractive looking.

Substances which contain sulphur, such as crabs, lobsters, shrimps, mutton, sweet corn, and impure sugar, cause blackening in the presence of iron and tin. When the cans are processed, the heat drives off the sulphur, and hydroxide of tin is formed, which covers the surface of the container with a black colour, but the discolouration does not penetrate to the can contents. With iron, however, a sulphide of iron is formed, which not only discolours the sides but also penetrates the contents of the can. Blackening may result from the formation of tannate of iron, and is seen in cans containing apples, strawberries, raspberries, or beans (the coats of the beans contain tannate forming substances).

Cans are lacquered to prevent discolouration of the contents, and, in order to avoid penetration of the contents by sulphides, the lacquered cans are lined with parchment paper.

(3) Bulging of cans from formation of hydrogen gas.—The action of the acids in the can contents on tin and iron results in the liberation of hydrogen gas, which causes bulging or swelling of the can. This may be slight or may be so intense as to cause the can to bulge almost to bursting point. The condition is known as "hydrogen swell". "Hydrogen swell may be caused by any foodstuff containing organic acids"; it occurs both in plain and in lacquered cans, and "corrosion of the lacquered can may be more serious than that of the plain ones".

The action which takes place within the can is due to the setting up of electric currents; the electric couple consists of the tin and iron, while the electrolite is supplied by the acids of the can contents. Decomposition of the tin or iron or both may result. Oxygen promotes corrosion of both tin and iron, but corrosion of iron even in the absence of oxygen is common. It results in the liberation of hydrogen gas and bulging of the container. When oxygen is present the hydrogen combines with it to form water, and decomposition of the metal continues so long as oxygen is present. Tin possesses a high hydrogen overvoltage, and in the presence of oxygen the metal dissolves rapidly, while in the absence of oxygen dilute organic acids such as citric, and tartaric acids (common in fruit) do not appear to corrode the metal to any appreciable extent. In the

absence of oxygen the hydrogen set free by the corrosion forms bubbles around the tin and prevents further decomposition, whereas in the presence of oxygen the hydrogen unites with it and decomposition continues until all the oxygen has been utilized.

Apples contain a considerable quantity of oxygen; it is therefore customary to drive off as much of the gas as possible by bleaching with steam before canning the fruit, the process being further assisted by thorough exhaustion of the can.

It has been found experimentally that certain substances promote corrosion or act as " accelerators ", while others retard it and are known as " inhibitors ". Advantage is taken of these factors in the canning industry in order to minimize corrosion and the formation of " hydrogen swells ".

The conditions favouring the formation of hydrogen swells and perforations are:

HYDROGEN SWELLS.

1. Low acidity.

2. Lacquer on the inside of the can.

3. The presence of substances, such as sulphides, which accelerate corrosion with products of high acidity.

4. Storage of canned goods at high temperatures, and inefficient cooling of cans after processing.

5. The presence of solids and other substances which absorb tin salts, and so encourage de-tinning and consequent exposure of the iron.

6. Inefficient exhausting, which leaves oxygen in the can after sealing and encourages de-tinning.

7. Insufficient head space in the can, so that any hydrogen which may be produced will cause the can to swell rapidly.

PERFORATIONS.

1. Low acidity.

2. Lacquering.

3. The presence of large quantities of oxygen, due to inefficient exhausting or to minute pores produced in the can at the seams by the use of paper gaskets or by other mechanical means.

4. The presence of anthocyanin pigments or other oxidizing agents, which act as hydrogen-acceptors or depolarizers.

5. The presence of substances which render tin salts insoluble.

6. Inefficient cooling of the cans and storage at high temperatures.

REMEDIAL MEASURES.

1. Careful attention to technical and mechanical details, such as efficient exhausting and perfect sealing.

2. Adjustment of the acidity of the syrup in canning fruits of low acidity by the addition of 0·3 to 0·5 per cent of citric acid.

3. Care in selecting sugar free from sulphur compounds, which might act as accelerators of corrosion with highly acid products.

4. The use of beet sugar containing an inhibitor of corrosion, or possibly the addition of small quantities of an inhibitor like agar-agar.

It is unfortunate that lacquering, which is necessary in order to check discolouration, should generally have the effect of increasing the rate at which hydrogen swells are formed. It has been shown, however, that adjusting the acidity gives a high degree of protection both for lacquered and plain cans, and the opinion may be expressed that this, and cool storage, are the safest and most effective methods of checking corrosion by fruits of low acidity, which normally give trouble.

Inspection of Canned Foods.—The following brief notes on this subject are based on observations made by Dr. Savage in the report to which reference was made on p. 307. Canned goods are inspected at the ports of entry into the United Kingdom. It is obviously impossible to inspect every can, as the number of tins in one consignment often amounts to tens of thousands, and resort is had to a system of " sampling ", only some 10 per cent of the cases being examined. The canned meat is generally examined at the wharf by the wharfingers. This is done primarily for trade purposes, but it also materially assists the Food Inspectors in this part of their duties.

A full examination of the unopened tin comprises inspection, palpation, percussion, and sometimes shaking—a form of auscultation. To a doctor, therefore, the methods employed resemble those used by him for the physical examination of the human chest.

Inspection.—Well-defined holes, marked indentations, and other signs of gross ill-usage are at once detected by inspection. If the cans are much rusted it is likely that a proportion of them will have rusted through in places, and so give rise to a high proportion of leaky tins, which will have increased by the time the tins have reached the consumer. The most important defect detected by inspection is the presence of any swelling or " blowing ". This is generally accepted as a sign of gaseous decomposition of the meat, and is indicated by the ordinary flat or slightly concave surfaces of the can being bulged owing to the pressure exerted by the gases of decomposition within. Such cans should, as a rule, be rejected, but it should be remembered that the vacuum ensures the meat being in contact with the tin all over, and, if there is a dent in one

part, there will generally be a slight bulge elsewhere, as room must be found for the contained meat. The presence of a second vent hole in a can should always be regarded with suspicion, as it may indicate that the tin has been " vented " to let out gases caused by bacterial decomposition and then resealed; but such a dishonest procedure is seldom resorted to, and it should be remembered that a second solder hole is sometimes made in the ordinary process of manufacture. No adverse significance, therefore, need necessarily be attached to the presence of more than one solder hole in otherwise sound tins of meat.

Palpation.—Palpation means the feel of the can when held in both hands. When the vacuum is lost the tin ceases to be closely adherent to the meat in one or more places, or even extensively, and there is a springy feel which is quite distinctive. This loss of vacuum can only be due to access of air or production of gas, and is always associated with a definite kind of note when the can is percussed.

Percussion.—In practice, apart from obviously blown or otherwise obtrusively unsound tins, reliance is placed mainly upon percussion, i.e. the character of the sound yielded by tapping the surface of the tin. This is usually done with a piece of wood, but some inspectors prefer their fingers. A sound tin emits a dull note, while, if the tin contains air or gas, the note is " tympanitic " or like that produced by a drum. This drum-like note is generally found in parts only and not all over, but in bad cases it may be found over every part of the tin. Tins which fail to give the dull note all over are generally rejected. In this connexion it should be remembered, however, that a perfectly sound tin may emit a drum-like note.

Shaking.—Only if the meat is in an advanced state of decomposition and partly liquid are any results of value likely to be obtained. The ordinary canned meat tin is solid throughout and yields no sound on shaking. When fresh meat, i.e. not salted or corned, is canned a little water is usually added to prevent the final product being too dry, and if this is excessive in quantity, the contents may " shake loose " with a characteristic sound even though the contents are perfectly good.

If, as a result of the external examination of cans, the inspector is in doubt concerning the wholesomeness of their contents, it is a good practice to open some of the tins and carefully inspect the meat, which should be of good colour and firm consistence. If it is

discoloured, markedly soft and friable, or possessed of a putrefactive odour, it should be condemned without hesitation.

The question has at times arisen whether naked eye inspection of the meat, without bacteriological or chemical examination, is sufficient to settle whether the meat is sound or unsound. On this matter Dr. Savage states: " Our results show definitely that a naked eye examination is all that is required in ordinary cases. Of the samples examined, 49 appeared perfectly good in every way when opened. Of these, 42 were sterile, and the remaining 7 only contained bacteria which were harmless, usually present in but scanty numbers, and which were incapable when experimentally tested of initiating any decomposition changes in artificially inoculated tins of corned meat."

Metallic Contamination of Canned Foods.—In a report of the Local Government Board by Dr. G. S. Buchanan[1] and Dr. S. B. Schryver on the presence of tin in certain canned foods Dr. Buchanan states:

" Practically all foods canned in the ordinary way become to some extent contaminated with tin as a result of the contact of the food with the tinplate of the can. Tin is taken up by meat extracts and essences to a greater extent than by most other meat foods. This results from the acidity naturally possessed by meat extractives in these preparations. Certain canned fruits and vegetables, and foods such as canned soups of which the latter form part, are also specially liable to take up tin from the can in consequence of their natural acidity. Canned peaches, cherries, pears, apricots, pineapples, tomatoes, asparagus, canned fruit puddings, and tomato soup are included in this category.

" Notable quantities of tin have been found in certain samples of tinned lobster.

" It would be unsafe to dogmatize as to the exact degree of contamination by tin which would render canned foods liable to cause irritation and so call for their condemnation, especially as much more of some canned foods is eaten at a time than others. Nevertheless, it seems clear that in any kind of canned foods quantities of tin approximating to two grains to the pound are not only unusual and unnecessary, but also must be regarded with grave suspicion in consequence of the risk of irritant action of the tin they contain."

[1] Now Sir George S. Buchanan.

FOODS PACKED IN GLASS

Glass Containers.—Many goods are put up in glass dishes instead of tins. There is great variety in the size, shape, and design of such utensils. The chief difficulty experienced in the employment of glass for this purpose was to obtain a reliable air-tight seal between the glass and the metal lid. This is generally overcome by placing a rubber washer between the surface of the glass and the metal cap. It is essential, however, if such joints are to be air-tight, that sufficient pressure be exerted between the cap and the vessel. This pressure may be obtained in one of two ways with two different types of metal cover.

Automatic Cap.—In the case of the ordinary automatic cap, the required pressure is obtained by producing a partial vacuum within the glass vessel during the sterilizing process. The glass receptacles to which this form of cap is fitted are made with a projecting rim running round the outside, at a lower level than the rim proper. On this projecting rim lies a rubber washer. The cap, which closely fits the rim proper, is made with a projecting flange which rests upon the rubber washer. This washer, being situated on the outside of the vessel, cannot in any way come in contact with the contents, and thus any chance of antimony poisoning derived from the rubber is avoided.

Mode of Fixing the Lid.—When the dishes, filled with the foodstuff, are being sterilized, their lids are temporarily held in position by spring clamps of such strength as to admit of the escape of contained air and steam generated during the process. After sterilization is completed, and the vessels have become cool, a partial vacuum forms in their interior, due to the contraction of contained air and the condensation of steam, with the result that their lids become concave and firmly fixed in position by the atmospheric pressure acting on their exterior.

Phœnix Cap.—This cap, which is employed chiefly for vessels with narrow orifices, depends on a mechanical contrivance for the pressure which is required to make an air-tight joint between it and the glass container. In this type of cover the seal is obtained by a rubber washer which is compressed between the under surface of the top of the cap and the upper surface of the rim of the receptacle. The whole being secured in position by a tin collar, the upper margin of which is turned over so as to grip the outside edge of the

top of the cap, and the lower margin pinched under the projecting rim of the neck of the receptacle, thus holding the cap down against the elastic recoil of the rubber washer. Between the rubber washer and the rim of the vessel a sheet of tinfoil is placed, which prevents the contents coming in contact with the rubber, thus shielding them from the possibility of becoming contaminated with antimony which that substance is supposed capable of imparting to them.

The pressure required to form an air-tight joint is obtained by a specially constructed press, so regulated as to compress the rubber washer to about half of its original thickness. When the desired pressure is obtained the metal collar is flanged over the outer edge of the cap above, and under the projecting rim of the neck of the receptacle below, thus holding and retaining the cap firmly in position. After the lids have been placed in position the vessels are sterilized in the ordinary way.

STERILIZATION.—Like cans, the sterilization of glass-packed goods may be carried out by one of two methods, either in open vats or in steam retorts. Glass vessels, however, on account of their liability to crack, are seldom exposed to such high temperatures as those to which cans are subjected.

Thus in the open-vat method ordinary water, instead of calcium chloride solution, is employed, giving a temperature of about 212° F.; and when the retort is used no higher degree of temperature is made use of.

Another respect in which the preparation of goods in glass differs from those in cans lies in the fact that their sterilization is carried out in one stage only; thus, whether the open vat or retort is used, they are only subjected to one heating process.

RESPECTIVE MERITS OF THE CAPS FROM A HYGIENIC POINT OF VIEW.—It will be noted that the first-described type of lid is held in position only so long as a partial vacuum exists in the glass vessel which it covers. If any flaw exist between the lid and the receptacle, or if the contents be improperly sterilized and putrefaction with gas formation set in, the vacuum will be lost, and the lid will in consequence drop off. It is therefore necessary that great care, cleanliness, and attention to efficient sterilization be exercised in the preparation of goods put up in this fashion, and all these points are hygienically strongly in favour of this form of packing.

In the other type of containers detachment of the cover would not arise in similar circumstances; a slight bulging of the lid might occur in the case of putrefaction, but nothing more noticeable would

manifest itself, and therefore this type of lid cannot be looked upon with such favour from a hygienic point of view.

The so-called " sterilization " of preserved foods, as used by manufacturers, is often misleading, because all that they intend to imply by the term is that the goods have been heated to a sufficient temperature to prevent putrefaction taking place. Investigations have shown that canned meats may contain living organisms though apparently free from putrefactive changes. Thus the " sterilization " to which canned meats are subjected, though rendering the ordinary putrefactive organisms incapable of producing harm, does not necessarily ensure the destruction of all the micro-organisms present in the meat. It is therefore a matter of great importance that all meat used for canning should be carefully inspected to see that it is sound and free from disease.

The process of " sterilization " in most factories seems to be carried out in rather a haphazard manner, being left pretty much to the foreman in charge, who relies on past experience to guide him as to how long goods of a certain weight should be exposed to the heat. It would be advantageous were the exact temperature and time of exposure more accurately regulated, as by that means more uniform results would be obtained.

Dr. MacFadden, in a report to the L.G.B. on Preservatives in Meat Foods, speaks of the relative advantages of glass- and can-packed goods as follows:

" It is undoubtedly more difficult to produce meats properly preserved by means of heat in glass containers than in cans. The high temperature to which canned materials may be subjected for long periods without risk renders the sterilization of such meats a much more certain process than is the case with glass-packed goods. None of the manufacturers whom I saw had experienced any real difficulty in preserving their canned products by means of heat, and all denied using preservatives, or the necessity for using them, to supplement this process in canned goods. To this extent canned meats in general might be said to possess advantage, from the point of view of wholesomeness, over meats which are packed in glass. On the other hand, the difficulties met with in sterilizing glass-packed meats necessitate the observance of greater cleanliness and care in their preparation (*so long as preservatives are not added*) if satisfactory results are to be obtained. Added to this is the fact that their contents are more or less capable of inspection by the purchaser, and are for this reason very unlikely to contain any of the grosser contaminations which have been reported in some American canned foods, for example."

" The freedom of glass-packed meats from liability to metallic con-

tamination is another point which may be noted in their favour, though the practice among some British manufacturers of repacking in glass imported meats which have just been turned out of their cans for the purpose, is calculated to shake the confidence of those who rely for protection in this respect on buying only meat preserved in glass containers."

SAUSAGES

While most sausage makers use nothing but thoroughly sound meat in the preparation of sausages, it must be remembered that the sausage gives greater facilities for improper materials being used in its manufacture than perhaps any other form of food.

Inspection.—It is difficult by a mere inspection of its exterior to form an opinion as to the fitness of a sausage for consumption. Should it be discoloured, or possess a disagreeable smell, it should of course not be used. To test sausages the inspector may cut one across, and if there is any suspicious odour it may be intensified by pouring over the cut end either hot or lime water. If the presence of horse-flesh be suspected, the contents of the sausage can be removed and tested for glycogen by the method described on p. 189.

The only way of ensuring the wholesomeness of sausages, as indeed of all prepared foods, is to supervise their manufacture at the factory.

Manufacture of Sausages.—A great variety of materials is used in sausage-making: pork, beef, chicken, ham, and internal organs such as liver, heart, &c., being among the more common.

The meat (whatever its nature) is first minced in a machine adapted for the purpose. The chief objection to such machines is that they heat the meat during the process of mincing, thus favouring the subsequent growth of micro-organisms. The minced meat is then mixed with meal, rice, flour, chopped bread, biscuit, or sausage meal, and the whole seasoned with salt, pepper, and other condiments. It is then put into the barrel of a sausage filler or " stuffer " and forced by a plunger through the nozzle into the skin, or casing, placed ready to receive it. There are many patterns of sausage fillers now on the market, but those made of cast iron with porcelain enamel inside the barrels are the best.

Odd scraps of meat are often used for sausage making, and may be unwholesome. Butchers who make sausages generally prefer the flesh of bulls, which is firm, and contains comparatively little

fat; the flesh of old, thin animals, which are known as " mincers " in the trade, is also employed for the purpose.

Preservatives were formerly commonly added to sausage meat, but under the Public Health (Preservatives, &c., in Food) Regulations, 1925, no preservative other than sulphur dioxide (450 parts per million) may be added to sausages. (See p. 467.)

Varieties of Sausages.—Many varieties of sausages are on the market. The list below gives the more common forms used in this country.

Cooked Sausages.

Luncheon and Breakfast Sausages are made of pork or beef, fat, breadcrumbs, and seasoning, the mixture being filled into cattle bungs, and smoked, or cooked with smoke powder, and then coloured and boiled.

Saveloys.—Scraps of lean beef, pork fat, bread, rusks, seasoning and smoke powder are filled into hog casings, linked and cooked.

Black Puddings.—In the manufacture of black puddings, the blood which enters largely into their composition may be raised to the boiling-point by means of steam, and it is necessary that it should " froth well up " in the process if the puddings are to turn out well. (Blood does not always undergo a preliminary boiling.) The boiled blood is then thoroughly mixed with chopped suet, oatmeal, and spices, after which the resulting mixture is filled into ox runners. The puddings are then boiled for about 30 minutes, and afterwards dipped in soda solution, which intensifies the black colour and imparts gloss to the exterior.

Uncooked Sausages.

Pork and Cambridge Sausages.—Lean and fat pork are minced, mixed with rusks and seasoning, and filled into sheep and hog casings, " linked " and made into chains.

Beef Sausage.—Flesh from the " clod and sticking " and flanks are mixed with rusks or bread and seasoned, and when minced are filled into sheep and hog casings and " linked ".

Chippalata.—First-class beef and pork are mixed with rusks or bread, minced, seasoned and filled into lamb casings and linked up into small links.

OTHER MEAT PRODUCTS

Brawn is made from meat cut from the heads of pigs and cattle. Being of a gelatinous nature, much jelly is produced when it is boiled. The jelly is strained off, and the boiled meat cut, as nearly as possible, into squares either with a knife or a brawn-cutting machine. The meat is put

into glass moulds or other suitable dishes, which are thereafter filled with the jelly. The moulds are then set aside to cool and solidify, after which they are ready for use.

Potted Meat.—Lean beef free of bone is finely minced, seasoned, boiled, packed into glass containers, and covered over with a layer of mutton fat.

Chitterlings.—The stomach and large intestines of the pig are thoroughly washed, and are then plaited, seasoned and cooked, and sold as " chitterlings ".

Savoury Ducks or Faggots.—Scraps of liver, cooked sausage, meat from the cheeks, onions, bread or rusks, and seasonings are mixed, minced and rolled into balls; these are packed into tins and baked for about two hours and are sold as " faggots ".

Hazlets.—These are made from lean pork, rusks, and seasoned, the mixture is then minced and made into oblong masses surrounded in caul fat, or is filled into sheep bungs and roasted at a high temperature.

Beef Extracts.—Lean beef is extracted in boiling water under great pressure; the liquid is then evaporated in vacuo.

Suet.—Loin or kidney fat of cattle may be sold simple or shredded. After being freed from all traces of blood and glands (kernels) it is minced and dusted with rice flour (this must not exceed 8 per cent).

Lard.—Fat from the leaf or " flair " (the retro-peritoneal fat along with part of the diaphragm) and back of the pig with the rind removed is rendered down in a steam-jacketed pan, and is filled into hog bladders and sold as lard.

INSPECTION OF PREPARED FOODS AT THE TIME OF MANUFACTURE

The only satisfactory method of safeguarding the consumer in regard to the character and quality of canned meats, sausages, brawn, and other forms of prepared foods is to carefully supervise (1) the quality and condition of the materials from which they are made; (2) the manner in which they are manufactured; (3) the condition of the premises where such manufacture is carried on.

Enough has already been said in a previous section to enable the inspector to satisfy himself as to the quality and condition of the raw materials; the other points to be attended to in such an inspection may be summarized as follows:

PREMISES.—The premises where the manufacture of food is carried on should be specially constructed for the purpose. Too often outhouses at the rear of other buildings, originally used for

some other purpose, are employed, and are seldom satisfactory.[1] It is very important that there should be an adequate arrangement of workrooms for carrying out the various stages of manufacture under favourable conditions. In small factories all the various processes are carried out in the same apartment. Where this is done, and where, for example, the sterilizing and cutting-up processes are carried on in the same room, the heat caused by the presence of the steam sterilizers favours putrefactive changes in the meat. All rooms where food is prepared should be well lighted and efficiently ventilated; the floors should be sound, and are best made of some hard impervious material such as concrete; the inside walls should have a smooth, hard, and easily cleaned surface, and all angles and corners ought to be avoided. The presence of gully traps or other openings of drains inside the premises is very undesirable. Lavatories, cloakrooms, wash-hand basins, and clean towels for the use of workers are essential.

WORKERS.—Persons employed in the making of prepared foods should be healthy. Their hands ought to be kept clean, and they should wear clean overalls while at their work. In many of the large American packing-houses a manicurist is regularly employed to look after the finger-nails of the employees.

METHODS EMPLOYED.—It is very important that the meats used in the manufacture of prepared foods should be sound and fresh. Instances have been known in which unsound canned food of various kinds have been used. It is the duty of the inspector to satisfy himself as to the quality of the raw materials.

ADDITION OF CHEMICAL PRESERVATIVES.—The use of preservatives in food is controlled by the Public Health (Preservatives, &c., in Food) Regulations, 1925. No preservative is allowed in meat other than sulphur dioxide (450 parts per million), which is permitted in sausage meat. Common salt, saltpetre (sodium or potassium nitrate), sugars, lactic acid, and acetic acid, or vinegar, glycerine,

[1] The conditions which must be observed in rooms in which food is prepared are set out in Section 72 of the P.H. Act, 1925 (see p. 420).

Art. 6 of the P.H. Meat Regulations, 1924, provides that no person suffering from an infectious disease, to which the Infectious Disease (Notification) Act, 1889, applies, shall take part in the handling of meat. The P.H. (Infectious Diseases) Regulations, 1927, states that where persons are suspected to be dysentery, typhoid, and para-typhoid carriers, the M.O.H. may, by written notice to the manager of the business where such persons are employed, if such business is concerned with the preparation or handling of food or drink, certify that it is necessary to make a clinical examination. If the examination, clinical, bacteriological, or protozoological, is positive the M.O.H. by written notice may prohibit the employment of such persons during a specific period in any business where food is handled.

The M.O.H. may, with regard to actual cases of dysentery, typhoid fever, or paratyphoid fever, require that until further notice such person shall discontinue any occupation connected with the preparation or handling of food or drink.

alcohol, herbs, hop extract, spices, and essential oils may be added, as these do not constitute preservatives within the meaning of the Regulations.

There is no necessity for using chemical preservatives in the manufacture of prepared foods provided proper methods are employed.

All apparatus and utensils used must be kept scrupulously sweet and clean. The blades of chopping and mincing machines, sausage-filling machines, &c., require to be carefully cleaned immediately after use. Where the nature of the work permits, the tops of tables may with advantage be made of marble or enamelled iron. Food materials in uncovered utensils should never be placed on the floor, as contamination is apt to result.

CHAPTER III

Post-mortem Changes in Meat and Causes of Unwholesomeness in Food

Post-mortem Changes in Meat—Rigor Mortis—Discolouration—Putrefaction—Phosphorescence—Mould Formation.

Causes of Unwholesomeness in Food—Influence of Flesh of Diseased Animals — Danger to Health from eating Flesh containing Parasites — Meat Poisoning — Salmonella Group—Botulism—Dysentery Bacillus—Bacillus Proteus—Other forms of Poisoning.

Appendix A: Tables from 100 Investigations of Outbreaks by Savage and Bruce White—Vehicles of Infection—Bacterial and Chemical Causes—Disease-producing Rôle of Bacteria of the Salmonella Group.

POST-MORTEM CHANGES IN MEAT

Rigor mortis, or setting, usually begins soon after death, and is complete in ten to twelve hours. It consists of a stiffening of the muscles, which commences at the head and spreads down over the body. It is due to coagulation of the myosin of the muscles. Its occurrence depends upon several conditions; the carcass of animals which have been fevered show little or no stiffening, high temperature of the room in which the carcass is kept hastens, while cold atmospheres delay rigor mortis.

Discolouration.—When the animal has been dead for some time (especially if it has not been bled) without having had its internal organs removed, a discolouration in the abdominal region is frequently met with. The stains are generally of a greenish yellow colour, and may be due to the permeation of bile from the gall-bladder, the breaking up of the colouring matter of the blood contained in the tissues, or to decomposition.

Putrefaction or Decomposition.—Putrefaction is produced by bacteria which have gained access to the meat after the death of the animal. Conditions which predispose to putrefaction are heat, moisture, and unhealthy animals (those which have died as a result of disease, or have been slaughtered when fevered).

Putrefaction generally starts from the surface, and penetrates to the deeper tissues, but in refrigerated carcasses organisms of decomposition spread along the track of the large vessels of the limbs and putrefaction commences deep down in the flesh near the bones, as a rule in the region of the hip or shoulder joints. This may also occur in hams and is known as " bone taint ". Putrefying flesh is little changed at first, but later becomes softer than normal and often looks moist, its colour may be dark green or black, and it has an offensive odour. There may be formation of gas with liberation of free ammonia.

Bone taint used to be frequently met with in imported meat, but as carcasses are put into cold store as soon as possible after slaughter the development of putrefactive organisms is inhibited and bone taint is now much less common. It may be detected by the insertion of a skewer into the region of the hip-joint. If commencing decomposition be present, a distinctive odour will be noticed on the skewer when withdrawn.

The bacteria which cause putrefaction belong to the " Saprophytes ". There are several such organisms, but the most common is the *Proteus vulgaris*.

Judgment.—Carcasses showing signs of general decomposition must be condemned with all the organs. (Memo 62, Foods, Sec. V *A* 8.)

Phosphorescence.—Two bacteria, the *Photobacterium sarcophilum* and the *Micrococcus plugeri*, are responsible for causing phosphorescence on meat, either cooked or raw. The condition is not injurious to health and disappears when the meat begins to putrefy, but it renders meat unsightly as it gives it a greenish white or bluish appearance in a dark room. The meat need not be destroyed, as sponging with weak vinegar or acetic acid removes the condition. The storage chamber should be cleansed and treated with acetic acid to prevent other meat from becoming infected. The bacteria are most active at a temperature below 36° F.

Mould Formation is caused by the growth of fungi or vegetable organisms, which form spores or threads, and appear as gradually spreading spots or patches on various kinds of foodstuffs. All moulds require suitable temperature, adequate moisture, and a supply of food to enable them to grow. They develop best in a temperature at which bacteria do not thrive, and are unable to live long in the presence of numerous organisms. Intermittent freezing,

or fluctuation of temperature in the freezing chamber, are frequent causes of the growth of moulds.

Moulds render food unsightly, although they do not cause it to be poisonous or dangerous to health. It is customary to cut out affected portions of meat, unless the moulds are too extensive, when the whole carcass must be condemned.

Disinfection of chambers in which mould has occurred is necessary, as, owing to the dissemination of spores, infection is apt to become widespread.

BLACK SPOT, or Black Mould, is due to the fungus *Cladosporum herbarum*. It grows at a temperature ranging from 18° F. to about 60° F. and forms spores through whose agency the mould spreads from carcass to carcass. The black spots vary from olive green to black in colour, and from quarter to half an inch in diameter. The inspector should examine the skirt and pleura of beef, and the legs and interior of the carcasses of frozen mutton. Chilled beef taken from ships and placed in cold stores at a temperature above 18° F. is liable to develop black spot.

WHITE MOULDS.—Two kinds of white mould are found on meat, the one resembles black spot in character, but is white, and is called " white spot "; the other, because of hair-like filaments which it forms, is known as " whiskers ".

WHITE SPOT is caused by the *Sporotrichium carnis*, which gives rise to small white spots on the carcass. Growth occurs but scantily at a temperature of 18° F., more plentifully at 28° F., and it becomes profuse when the temperature rises above that of freezing-point (32° F.).

WHISKERS may be caused by one of two fungi, *Mucor mucedo*, or *Thamnidium*; these are almost indistinguishable. Growth is very scanty at 18° F., but increases as the temperature rises and becomes abundant about freezing-point. The appearance of the moulds resembles hoar frost, from the growth of fine hair-like processes, from which the name " whiskers " is derived. This condition is unlike the two former moulds in that it can be removed from the carcass by sponging with weak acid.

GREEN MOULD is caused by a fungus known as *Pencillium*; it is uncommon on meat, as it grows best at temperatures above the freezing-point.

YEAST.—The saccharomyces, or yeasts, may grow on meat, and form slimy whitish-pink or pink spots, which become brown when dry. They do not develop at temperatures below freezing-point.

ACTINOMYCES.—The *Actinomyces bovis* is a mould which gives rise to the disease known as actinomycosis (see p. 121).

N.B.—For moulds on foods other than meat see p. 275.

CAUSES OF UNWHOLESOMENESS IN FOOD

Meat may be injurious to the consumer from a variety of causes.

1. It may be the vehicle through which pathogenic organisms are introduced into the body.

2. It may contain the intermediate forms of certain parasites capable of developing in the human subject.

3. It may give rise to "food poisoning".

INFLUENCE OF THE FLESH OF DISEASED ANIMALS UPON THE HEALTH OF THE CONSUMER.—Among the infectious diseases, tuberculosis, on account of its prevalence, must first receive consideration. As previously stated, tuberculosis is rarely found in the musculature or flesh of animals, and therefore it is frequently affirmed that the meat of tuberculous animals may be eaten with impunity. It must not be lost sight of, however, that the lymphatics which permeate the flesh, and the lymphatic glands which lie embedded in it, are very often affected with this disease. The question arises, therefore, is the heat of cooking the meat sufficient to destroy the tubercle bacillus in such positions? We know that this organism does not possess any very great degree of resistance to high temperatures, and that the higher the temperature the shorter the time of exposure required to destroy it. The thermal death point of the bacillus has been carefully studied in connexion with the pasteurization of milk, and it is known that exposure to a temperature of 145° to 150° F. for a period of half an hour will in the majority of cases kill the tubercle bacillus.

As flesh is a bad conducting medium, heat penetrates slowly into the centre of large pieces of meat. The results obtained depend upon the method of cooking employed. Thus, for the purpose of sterilization, roasting before a fire is the least and boiling the most effective method of cooking flesh. As a practical rule, it may be taken that if the interior of a piece of boiled or roasted meat retains much of the blood-red colour of uncooked meat, the temperature has not been sufficiently high to destroy micro-organisms. In the case of underdone grilled steaks, also, which are only exposed to the fire for a comparatively short time, it is very questionable whether they are rendered sterile by the process.

The experiments of Woodhead for the Royal Commission are interesting in this connexion. He artificially infected flesh, by injecting tuberculous material into its interior or by smearing slices

of meat and forming them into "rolls". He then subjected the samples to the ordinary process of cooking, and employed the central portions of them for feeding and inoculating animals. He came to the following conclusions:

1. The centre of a "joint", weighing 6 lb. or over, never reached a higher temperature than 60° C. (140° F.) during ordinary cooking.

2. Rolls of meat of more than 3 lb. or 4 lb. weight were not rendered sterile throughout, and therefore cooking could not be relied upon to render innocuous "rolls" with smeared tuberculous centres.

3. Ordinary cooking was sufficient to destroy any smeared tuberculous material on the outside of a "joint" or "roll".

4. The most trustworthy method of cooking is boiling, then roasting in an oven, and the least trustworthy, roasting in front of a fire.

The results obtained from meat smeared with tuberculous material are important, because healthy flesh is sometimes rendered infectious as a result of contamination with the butcher's knife previously soiled with tuberculous matter.

It should also be borne in mind that other parts besides the flesh are eaten. Most of the internal organs are a common form of diet, especially with the poorer classes, who regularly eat the lungs, udder, and mesenteries—all of which may be highly infective in a tuberculous carcass.

Apart altogether from bacilli, however, it is probable that, under certain circumstances, the meat from tuberculous animals may contain toxins; whether these are harmful to the consumer, especially after exposure to the temperature of cooking, is open to question.

The state of our knowledge as to the influence upon health produced by the ingestion of the meat of diseased animals—tuberculous or otherwise—is at present far from satisfactory.

"The probability is that, when attention is directed to the subject, the effect of diseased meat will be found to be more considerable than at present believed" (Notter and Firth).

Unquestionably the danger which may accrue from the ingestion of tuberculous milk is very much greater than that resulting from the consumption of imperfectly cooked diseased meat, yet that the latter is entirely devoid of all danger has not been conclusively shown. Anyone who has lived for a time on food of poor quality, and has thereafter been put on a diet of good wholesome food, must have experienced the great difference in the feeling of general well-being which was occasioned by the change. It is

therefore the duty of sanitarians, whose aim is to improve and maintain the public health by every means in their power, to see that the public are supplied with good meat from healthy animals.

Danger to Health from the Eating of Flesh containing Parasites.—*Cysticercus cellulosæ* in the pig and *Cysticercus bovis* in the ox may, if the flesh of these animals be eaten in a raw or imperfectly cooked condition, develop into the adult tapeworms—*T. solium* and *T. mediocanellata*—in the intestine of man. The pig sometimes harbours the *Trichina spiralis*, which gives rise to trichinosis if swallowed in the live condition.

Cysticerci seem to be comparatively readily destroyed by heat, a temperature of 113° to 122° F. being sufficient to kill them. When meat is properly cooked, therefore, the danger of infection from these parasites is slight. In order to be certain of rendering encapsuled trichinæ harmless a temperature sufficient to coagulate albumen is necessary, and to do this meat requires to be very thoroughly cooked.

The encysted form of the *Bothriocephalus latus* is passed in either the pike or turbot; it may be conveyed to man through eating such fish when imperfectly cooked.

Other Causes Rendering Meat Unsuitable for Consumption.—The use of choppers and cleavers by butchers may cause small splinters of bone to become lodged in the flesh. Such bony fragments may be a source of danger either by damaging the teeth of the consumer, or, should they be swallowed, by injuring the gastro-intestinal tract. For this reason the use of the saw in butchering should be encouraged as much as possible.

Meat Poisoning.—Meat poisoning is the name given to a group of ill-defined cases of poisoning resulting from the ingestion of some form of animal food.

On the Continent meat poisoning has with considerable frequency been found to follow the consumption of meat from animals slaughtered while sick. From the records of these outbreaks it would appear that certain forms of septic diseases are especially prone to render meat poisonous. These include the septicæmic forms of calf lameness, hæmorrhagic enteritis of calves, septic metritis of cows, several intestinal disorders, and various other diseases of a septicæmic or pyæmic order. Further, the flesh of animals which, for one cause or another, were submitted to emergency slaughter, has not infrequently given rise to poisoning.

The following diseased conditions were observed in the animals

whose flesh was responsible for some of the more important continental outbreaks of food poisoning. (1) Cow suffered from gastro-enteritis. (2) Cow suffered from purulent inflammation of the udder, and was in consequence subjected to emergency slaughter. (3) In an outbreak due to the consumption of horse-flesh, the animal was known to have suffered from abscesses. (4) Calf suffered from enteritis fourteen days before slaughter. (5) Meat from two calves suffering from severe enteritis; one died, the other was killed when on the point of death. (6) Cow fell ill after calving and died. (7) Cow killed on account of diarrhœa and fever. (8) Cow emergency slaughtered on account of diarrhœa and fever. (9) Calf 5–6 weeks old and suffered from arthritis. (10) Calf suffered from severe enteritis. (11) Cow emergency slaughtered for puerperal sepsis. (12) Cow emergency slaughtered for udder disease. (13) Upon the otherwise sound pig the butcher found an abscess upon one cheek, which was removed after the death of the animal; later he noticed, in cutting up the pig, an abscess, which he removed in the slaughter-house. (14) Cow emergency slaughtered on account of gastro-enteritis. (15) The horse suffered from gastro-enteritis and had an epigastric abscess.

In two accounts of British outbreaks similar conditions were noted, namely, at Murrow in 1908, where the consumption of brawn made from the meat of a pig gave rise to food poisoning, it was discovered that the animal had suffered from abscesses on one of its feet; and at Limerick in 1909, there was reason to suppose that the animal was not in a healthy condition. But the vast majority of reports on food poisoning outbreaks in this country contain little or no information respecting the health of the animal from which was derived the meat responsible for the symptoms of poisoning. In a few instances there is a statement to the effect that the investigator was informed that the animals were healthy, but no evidence is furnished in support of the contention.

The majority of British outbreaks have been attributed to the Salmonella (previously called Gaertner) group of micro-organisms. The fact that outbreaks of food poisoning in this country have seldom been attributed to the use of the flesh of diseased animals may perhaps, in some measure at least, be accounted for by the many difficulties experienced in obtaining the necessary information, and should not be accepted as conclusive evidence that the animals were, in fact, in a healthy state. It is very important that careful inquiry should be made respecting the health of the animal from

which the flesh was derived in connexion with all cases of food poisoning.

In this connexion, in a report to the Medical Research Council on a study of a hundred recent outbreaks of food poisoning, Savage and Bruce White state that in considering infection from an animal source, two possible modes of infection have to be distinguished, namely: (*a*) infection may be due to the meat or milk of an animal infected with a Salmonella bacillus being used as part of the implicated food, or (*b*) it may be due to sound food being infected with bacilli derived from an animal either suffering from a Salmonella infection or acting as a carrier of such bacilli. In the series of outbreaks considered in the report there is little definite evidence that a diseased animal was implicated. In one of the outbreaks investigated by Dr. Picken, *B. Ærtrycke* (one of the Salmonella group of organisms) was isolated from a cow which appears to have given rise to food poisoning through the agency of her milk. The cow appeared perfectly healthy and it is not known whether she was actually infected or merely a carrier.

Another outbreak which occurred in Manchester in 1922 and was investigated by Young and Dawson is of interest. The twenty-five cases were due to the consumption of mutton and *B. Ærtrycke* was isolated and shown to be the cause. This bacillus was isolated from the bone-marrow of the joint of mutton as well as from other sources. The authors suggest that this is strong evidence of intra vitam infection, which it undoubtedly is.

The Salmonella Group.—Poisoning from organisms of this group is of two kinds: (*a*) that due to the living organism, and (*b*) that which results from the production of endotoxins formed by the bacteria.

(*a*) Poisoning from Living Organisms.—When one of the Salmonella group is present in the meat, but has not had time or opportunity to elaborate its toxin, or poison, the illness resulting from its ingestion is preceded by an incubation period, during which the bacteria develop toxins in the human body. At the end of this incubation period, which varies from twelve to forty-eight hours or longer in duration, well-marked symptoms manifest themselves consisting of abdominal pain, vomiting, and diarrhœa, along with rise of temperature, headache, and cramps in the muscles. If a large dose of the bacteria has been ingested the symptoms may supervene within twelve hours. Recovery is the rule, but it is somewhat protracted.

(*b*) Poisoning from Endotoxins.—If the bacteria have developed their toxins in the food before it is eaten, there may be no incubation period, and within two to four hours after the food has been consumed the symptoms of illness commence with acute abdominal pain, vomiting, and diarrhœa, with or without constitutional symptoms as under (*a*). The period of illness is as a rule short and sharp, resulting in recovery often within twenty-four hours. A fatal ending is rarely met with, but the patient may become acutely ill, collapsed, exhausted, and death may supervene.

In the study of 100 recent outbreaks of food poisoning made by Savage and Bruce White, no less than 70 per cent of the outbreaks were attributed to the Salmonella bacilli.

In investigating cases under (*a*) above, living organisms were recovered from specimens of vomit, fæces, or blood of some of the patients, and from organs of persons who had died from food poisoning. The blood of patients who are ill or who have recovered from the poisoning may show high agglutinative reaction to the bacillus—a point of great diagnostic value.

In 17 of the outbreaks ascribed to endotoxins of the Salmonella group no bacteriological proof was available, but all the patients had eaten canned foods, and the toxins of this group are " the only ones known which will resist temperatures of 100° C. and above ".

Mode of Infection.—It should be understood that food which has been infected with organisms of the Salmonella group may appear to be perfectly sound, and the fact that it is infected cannot be detected by taste or smell. In the 100 outbreaks " in only three was the food other than perfectly good to the physical senses, and of these one was due to a living Salmonella strain, and two to undestroyed Salmonella toxins ".

The manner in which food becomes infected with these bacteria is usually obscure. Occasionally it has been shown that the animal which yielded the incriminated food was diseased. Sometimes it has been found that the person who prepared the food had previously suffered from an attack of food poisoning, and was a " carrier " of the Gaertner bacillus, though this is now believed to be rare. Such a person may appear to be perfectly well at the time when he or she handled the food, but bacteriological investigation may result in the recovery of the specific micro-organism from his or her fæces or urine, and, owing to unclean hands or in other ways, the food may become infected. Persons carrying bacilli in their system in this way may remain infective for years. It is recognized

that typhoid fever carriers and diphtheria carriers are relatively common, and carriers of the Salmonella group of micro-organism are occasionally met with. It is therefore necessary, when investigating an outbreak of food poisoning, to make careful inquiries respecting the previous health of all persons who have handled the suspected food, and, in this connexion, a history of attacks of diarrhœa in the past must be regarded with suspicion. The aid of the bacteriologist should always be sought in conducting inquiries of this nature.

Occasionally infection of meat and other foods has been traced to the fact that gut scraping has been conducted on the premises where the infected food has been prepared. This is, of course, a most undesirable practice which cannot be too strongly condemned. Food-poisoning organisms may be present in the intestines of certain animals, particularly pigs, and, if gut scraping and the preparation of food are carried on in the same premises, the latter is liable to become contaminated by means of the hands or clothing of the workers. This group of bacteria may also be present in the intestines of rats and mice, and inquiry concerning contamination of the food by this agency should be made. Infection may likewise be carried through the agency of flies from some infective source, human or animal, or there may be contamination by means of bacterial rat virus, used for poisoning rats and mice, which contains micro-organisms closely resembling those of the Salmonella group.

Type of Bacilli.—Several types of bacilli have been identified in the Salmonella group, the most common of which are: *B. Ærtrycke* (the organism most often found), *B. enteritidis* of Gaertner (the bacillus from which the group originally took its name), bacillus of Newport, bacillus of Derby type, and the *B. suipestifer*.

Characteristics of the Bacilli.—Bacilli of this group are not themselves abnormally resistant to heat; they form no spores, they multiply rapidly on foodstuffs, but they produce powerful endotoxins which are not affected by high degrees of heat, a property which no other known endotoxins possess.

Botulism is a term applied to cases of food poisoning produced by the toxin of the *B. botulinus*, which generally gives rise to symptoms associated with intense poisoning of the central nervous system. The term is an unfortunate one, because botulus means a sausage, and it might be imagined therefore that such poisoning can only be caused by eating sausages, whereas the condition can be set up, not only by sausages, but by any other form of food which

may happen to be contaminated by the *B. botulinus*. This form of poisoning is relatively common on the Continent, but is comparatively seldom met with in this country.

As regards the more recent outbreaks, it may be mentioned that Bitter[1] observed three outbreaks of meat poisoning in Kiel between June, 1918, and June, 1919, and in each case was able to cultivate the *B. botulinus* from the infected foodstuff. Eight persons in all were affected, and of these three died. In two instances the source of the mischief was pickled herrings, and in the other ham. The cases were clinically typical of botulism, presenting ocular palsy, mydriasis, dry mouth, loss of speech, &c. As a result of investigation Bitter found that a concentration of 0·6 per cent acetic acid in a medium did not prevent the growth of the bacillus nor the elaboration of a powerful toxin. Safety could be obtained, however, by employing acetic acid of 2 per cent strength in pickling. Van Ermengem had shown long ago that 10 per cent salt prevented growth and formation of toxin. Bitter gives statistics dealing with the occurrence of proved cases of botulism in Prussia from 1897 till 1913; 70 outbreaks were recognized during that period, involving 302 cases, of which 51 were fatal, a mortality of 16 per cent. The poisoning was conveyed especially by ham, sausage, blood-puddings, salted fish, and preserved beans. There is evidence that the toxin is not completely destroyed by cooking.

Dr. Dickson, of the Stanford University Medical School, San Francisco, has investigated a number of outbreaks of botulism on the Pacific Coast of America.[2] His interest in the subject dated from an outbreak which occurred in December, 1913, after a banquet in a student's club house, when the only article of food taken by all the 12 students attacked was a salad of string beans (presumably our runner beans) prepared at the home of one of the members of the club. The *B. botulinus* was not recovered from the one student who died, and all the salad had been eaten, leaving none to examine; but the clinical picture was typical of botulism, and the peculiar type of thrombosis in the blood-vessels of meninges and brain, since shown experimentally to be characteristic of botulism, was first demonstrated in the fatal case by Professor W. Ophüls, pathologist of Stanford University.

Another outbreak occurred among a party of 15 at an hotel dinner at Escondido, California, in January, 1917. The most striking

[1] *Deut. med. Woch.*, November 20th, 1919.

[2] *Monograph No. 8 of the Rockefeller Institute for Medical Research*, July 31st, 1918.

symptom was progressive muscular weakness, especially marked in the head and neck.

In one outbreak the condition is described thus: "There was extreme flaccidity of the muscles of the neck, allowing the chin to rest upon the chest or the head to fall backward if not supported when the patient was elevated. It was a common occurrence to see a patient move her head with her hands, and one girl who had long braids used them, with the head of the iron bed as a pulley, to swing her head into position when she wished to move. The head could be rotated and held from falling to either side, but the anterior and posterior supports were lacking."

In America outbreaks of botulism have also been attributed to the consumption of preserved olives.

Loch Maree Outbreak.—In August, 1922, public attention in this country was directed to the subject of food poisoning by the tragic occurrence in an hotel at Loch Maree, Gairloch, Ross-shire, where eight persons died with symptoms suggestive of botulism. Sandwiches made with potted food or paste were eaten for lunch on 14th August by eight persons staying in the hotel. The earliest symptom was diplopia, and it was observed in one of the sufferers before breakfast on 15th August. Thus the shortest interval between ingestion of the sandwiches and development of the earliest symptom was about eighteen hours. The seven other persons affected began to suffer during the course of 15th August. Diplopia was the first noticed symptom in all instances; other prominent symptoms being a feeling of constriction in the throat, ptosis, dizziness, paralysis, and collapse. Vomiting occurred, but does not appear to have been a marked feature, and no mention was made of diarrhœa. Two ladies died on 15th August. The other persons affected were men, and two died on 16th August, two on 17th August, and two on 21st August.

The potted food in question had been made by a large firm of manufacturers, and it is possible that it may have become infected locally in some way not explained. Samples of the meat paste obtained from an uneaten sandwich and submitted to bacteriological investigation gave rise to symptoms of botulism in experimental animals.

So far as the writer is aware, this is the first authenticated instance of the occurrence of botulism in Britain. It should be understood that the poisonous effects are produced not by the *B. botulinus* tself but by the toxin it has previously produced in the food. In

order to produce this toxin, the organism requires certain conditions, namely, proteid material, of animal or vegetable origin, and a complete absence of oxygen. In America chickens suffer from a malady known as " limber neck ", which is believed to be a form of botulism. In the north of Scotland and other parts of Britain a fatal disease called " grass sickness " has recently occurred among horses, and it is stated that the symptoms are indistinguishable from those of botulism. If this is so, the manner in which the disease is transmitted from the domestic animals to man has not yet been elucidated.

DYSENTERY BACILLUS.—In no less than four outbreaks Savage and Bruce White believe the dysentery bacillus was the causative agent. The curious feature of the cases lay in the fact that the chief symptoms were those of " food poisoning " and the distinctive signs of dysentery (namely, the presence of blood and mucus in the stools) were unobtrusive or absent.

BACILLUS PROTEUS was formerly considered to be the cause of epidemics of food poisoning. Savage and Bruce White state that " in no instance have we been able to adduce any evidence that any one of them (*B. coli*, *B. proteus*, and Morgan's bacillus) had anything to do with the causation of the outbreaks in this series ".

The *B. proteus* is one which sets up offensive decomposition, and would render the food unpleasant to the taste and unsound.

BACILLUS COLI.—The investigators stated that they " had no evidence that *B. coli* strains were responsible for any of the outbreaks of food poisoning, and we know of no evidence that they can cause food poisoning ".

Other Forms of Food Poisoning.

Pies of any kind may be dangerous if they be cooked without an aperture being left in their crust. Sausages are sometimes poisonous on account of the fact that they are occasionally made from all manner of scraps, or from the meat of sick or ill-conditioned animals, and further, that exceedingly insanitary methods of manufacture are at times employed. They are generally smoked and highly spiced, so that any unpleasant smell or taste that they may possess is not easily detected. It is, however, not only meat or its compounds that are capable of giving rise to symptoms of poisoning.

Fish and shellfish either decomposing, or sewage polluted, may be dangerous to health. (See p. 252.)

Milk may be the vehicle of infection, and is dealt with in the section on milk. (See p. 381.)

Cheese may cause poisoning, and this was formerly thought to be due to the formation of a " ptomaine " known as " tyrotoxicon ", which is now believed to have no relation to the symptoms produced. In the outbreaks investigated by Savage and Bruce White, 8 per cent were associated with cheese, and the poisoning was thought to be due to endotoxins of a bacillus, in some cases of the Salmonella group.

APPENDIX A

The following tables are from the report of Savage and Bruce White.[1]

VEHICLES OF INFECTION

Tinned Foods (tongue 3, beef 5, mutton 1, salmon 15, sardines 2, crustaceans 3, fruits 3)	42
Milk and Milk Products (milk 5, cheese 8, cream 1)	14
Made-up Meat Foods (brawn 2, potted meat 6, meat pies 3, sausages 2, rissoles 1, faggots 1)	15
Manipulated but not Made-up Meat Foods (chicken-broth, pickled beef, frozen oxtail, stuffed mutton, frozen beef) ..	5
Fresh Meat	6
Fresh Fruit and Vegetables (tomatoes, plums, potatoes, apples)	4
Preserved Fruit	2
Other Foods (cockles, linseed tea, shrimps, fried fish)	4
Multiple not ascertained	8
	100

BACTERIAL AND CHEMICAL CAUSES

Outbreaks probably not true food poisoning	3
Outbreaks due to members of the Salmonella Group	66
Outbreaks due to members of the Dysentery Group	4
Outbreaks due to *B. botulinus*	1
Outbreaks of definite chemical origin	2
Cheese poisoning outbreaks	8
Milk evanescent outbreaks	9
Outbreaks of undetected bacterial origin	7
	100

[1] *Medical Research Council Special Report* Series, No. 92, 1925.

Disease-producing Rôle

Type	Man	Animal
B. paratyphosus A.	Paratyphoid fever.	Not found.
B. enteritidis.	Gastro-enteritis of food-poisoning type. Occasionally sporadic cases of illness.	Disease of cows and calves. Disease of rats. Probably also in other animals.
Derby.	Human food poisoning.	Pigs; exact disease-producing rôle unknown.
B. paratyphosus B.	Paratyphoid fever. Probably never food poisoning.	Not found.
B. Ærtrycke.	Food poisoning. Sporadic cases of illness (possibly).	A widespread cause of enteritis in mice, guinea-pigs, and other rodents. Enteritis in parrots and other birds. Occasionally found in pigs. Occasionally a cause of calf enteritis. Does not occur commonly in rats.
Stanley.	Food poisoning.	Not yet isolated from animal.
Newport.	Food poisoning. Possibly sporadic cases of illness.	Dog suffering from enteritis, otherwise unknown in animals.
Reading.	Inadequate knowledge.	Not so far isolated.
B. abortus equi.	Not found.	Abortion of horses.
B. suipestifer.	Paratyphoid fever (C type), food poisoning (very exceptional).	Secondary invader in pigs, in hog cholera. Occasionally as a primary cause of disease in pigs.

APPENDIX B

MINISTRY OF HEALTH MEMORANDA ON STEPS TO BE TAKEN BY MEDICAL OFFICERS OF HEALTH IN CASES OF SUSPECTED FOOD POISONING.

January, 1921.

It is very important that the Ministry of Health should receive early information as to all cases of food poisoning and that they should not be dependent for such information on casual sources, such as newspaper reports. It is, therefore, requested that Medical Officers of Health, whenever they have reason to suspect that any death or outbreak of illness in their districts is due to food poisoning, will notify the Ministry at the earliest possible stage. This is important both because the Ministry are frequently in a position to offer useful assistance in regard to the immediate measures to be taken, and also because of the opportunities so afforded to them for elucidating points in the causation of food poisoning which are at present obscure. Even where the Medical Officer of Health is only aware of a few cases of illness, the early notification of the matter to the Ministry is desirable as it may be that other cases are occurring elsewhere from similar causes (e.g. where one or two members of a household are suffering in consequence of the consumption of canned food from a particular tin; other canned foods of similar origin may be causing illness elsewhere).

In this connexion it may be mentioned that specific duties of reporting any outbreak of serious epidemic disease to the Ministry, and of sending a copy of any special report which he may make to his authority on any subject are imposed on the Medical Officer of Health under Article XIX (15) and (16) of the Sanitary Officers (outside London) Order, 1910, and by Article 18 (16) of the Sanitary Authorities (London) Order, 1891.

Cases of food poisoning arise from two main causes,[1] viz.:

(1) The contamination of foods by inorganic poisons (e.g. arsenic, antimony, copper and lead); and
(2) Bacterial contamination.

The latter is of much more frequent occurrence, especially in the case of foods of animal origin.

In any outbreak where the implicated food has been prepared in the district, it is advisable that as soon as the Medical Officer of Health has established the probability that a particular food is at fault, he should at once proceed to make detailed investigations into the conditions of its preparation, and obtain material for bacteriological or chemical examina-

[1] In the present memorandum, the term "food poisoning" is intended to include both classes of cases, but does not include instances in which foods, such as milk, ice-cream, or shellfish have produced any of the notifiable infectious diseases, for example, scarlet fever or enteric fever.

tion. Care should be taken to secure samples from all available food materials apart from those to which suspicion attaches at first sight. This is of special importance where it is suspected that the illness is due to an inorganic poison. It frequently happens that a food material which was not suspected in the first instance has ultimately proved to be the material at fault. The complete history of all the cases attacked should be obtained with the least possible delay as the determination of the circumstances in which food poisoning has occurred often turns upon the elucidation of apparently trivial points, and after some days' interval it is impossible to rely on accurate recollection of them. Moreover, as time goes on inaccurate statements get repeated and believed, and it is difficult to get at the facts. It is neither desirable nor necessary to await the result of bacteriological or chemical examinations before commencing inquiries calculated to throw light on the manner in which the poisonous elements (bacterial or other) gained access to the food. Supplementary inquiries can always be made as a result of laboratory findings. Steps should be taken to prevent further consumption of the suspected food by:

(1) Stopping its sale,
(2) Recovering unconsumed portions of that which has already been sold.

In view of the possibility of contamination of food materials by poisonous substances in transit by rail, it may be observed that railway companies possess information regarding consignments which is usually sufficient to enable an investigator to ascertain whether the food materials in question were carried in wagons containing arsenical or other poisonous preparations.

For convenience of reference, a list of headings for inquiry in the case of outbreaks of poisoning attributed to meat foods and inorganic poisons is appended to this memorandum.

Where the food suspected to have caused poisoning has not been prepared in the district it is important to secure the co-operation of the vendor, who should be invited to produce original packages, invoices, and any other facts available to show by what manufacturing or distributing firm the implicated food was supplied to him, and on what date and in what bulk.

The Ministry would be glad to be informed of the facts obtained in any such cases.

COLLECTION AND EXAMINATION OF MATERIAL

It is important to secure samples of any remaining portions of the actual food which has been consumed by persons attacked, as well as samples of food of similar origin, or food prepared from the same ingredients. Materials from persons affected, e.g. vomited matter, should

also be secured and where post-mortem examinations have been conducted, suitable materials should be obtained where possible. Perishable articles should at once be placed in an ice-box or cold store pending examination, which should be commenced as early as possible. In the case of canned foods, the cans with the labels intact should be preserved. Unopened cans, corresponding in all particulars with those suspected, should also be obtained if possible.

Chemical Examination.—Where the circumstances point to poisoning not of bacterial origin, samples with all the information available should forthwith be sent for chemical examination, and this would in ordinary circumstances be made by the public analyst of the district.

In cases of meat food poisoning samples are sometimes sent to the analyst to be examined for the presence of " ptomaines ". Ordinarily little is to be gained by so doing. It is by no means certain that " ptomaines " in the sense of alkaloidal substances produced by bacterial action are present in meat foods which have caused poisoning, and the significance of the reactions which are held to demonstrate the presence of these substances is a matter of considerable doubt. In such cases, however, chemical analyses may be valuable for the determination of special points, such as the presence or absence of preservatives and their nature, the determination of acidity, saltness, and like matters.

Bacteriological Examination.—It is of obvious advantage in the investigation of cases of food poisoning that arrangements for any necessary bacteriological examination should have been considered beforehand, and the delay and trouble of making special emergency arrangements avoided.

In addition to the examination of samples of suspected food materials, it is of importance that bacteriological examination should be made of materials from persons affected and particularly of the organs of fatal cases. The exact material required may vary in individual outbreaks, and in all cases the bacteriologist entrusted with the examination should be consulted. His advice should also be obtained in order that the material may be transmitted with proper precautions and in a condition suitable for examination. The serological reaction of the blood of persons attacked should always be bacteriologically investigated.

Where samples are liable to be delayed in transit it is desirable to send them in receptacles which are surrounded by ice or otherwise insulated.

It is important that material should be available for any investigations which the Ministry may desire to make through their own officers. Where such an investigation is directed, an early intimation will be sent to the Medical Officer of Health. In all cases, however, it is desirable that the chemist or bacteriologist consulted should be requested to preserve samples under suitable conditions until it has been ascertained that there is no further use for them.

The Ministry are aware that neither medical practitioners nor the general public are under statutory obligation to report cases of food

poisoning to the Medical Officer of Health. It is believed, however, that if it is generally understood in a district that the local authority, with a view to safeguarding the public health, is prepared to authorize any necessary inquiries and investigations, the arrangements made will receive general approval and tend to secure the co-operation of all concerned.

APPENDIX C

HEADINGS OF INQUIRY INTO OUTBREAKS OF POISONING BY MEAT FOODS

What cases heard of; steps taken to secure complete list of cases, e.g. inquiries of medical practitioners, neighbouring Medical Officers of Health and others.

Evidence implicating particular food or foods as cause of outbreak.

Evidence implicating any particular ingredient of the food.

Origin of suspected food or ingredient.

Inquiries in Affected Households

Names and ages of persons (*a*) in each household, (*b*) those ill, (*c*) those partaking of suspected food.

Persons affected (*a*) slightly, (*b*) seriously, (*c*) fatally; with date and hour of partaking of food in each case and date and hour of first symptoms in each case.

Clinical character of illness.

Particular food implicated. Date of purchase, source; any form of domestic preparation applied (e.g. cooking); if so, how long and to what degree; if canned meat, when opened, &c.

Inquiries at Place of Preparation (when Food Implicated has been Prepared in the District)

Address or description of place of preparation; name and address of owner or occupier; number of workers employed (male and female); nature of employment in each case. Any engaged also in other employments which might have connexion with contamination of the suspected food.

Meat concerned; its nature, where obtained, price paid, amount used on days concerned, how and where stored.

Evidence, positive or negative, of unsoundness of the meat.

Evidence, positive or negative, as to disease of animal from which material (meat or milk) was derived during life or ascertained post-mortem.

Possibilities of infection at slaughter-house or place of preparation or storage.

Sanitary condition of bakehouse or food preparing place (including

distance from possible sources of contamination, e.g middenstead, ash-pit, privy, W.C.; slaughter-house, stable); position of drain openings; ventilation; general sanitary condition.

Cleanliness of tables, floors, vessels, utensils, &c.

Preparation of food (exact details of methods employed, including history and condition of various component parts besides the meat, e.g. pastry, stock, and jelly for pork pies, skins of sausages, &c.).

Handling of the food (possible contamination by " carrier " of bacteria associated with food poisoning (*a*) before cooking, (*b*) during cooking, (*c*) after cooking, e.g. transfer into moulds, &c.).

Temperature reached in cooking; any experimental verification of temperature especially as regards interior of mass; any reason to suspect under-cooking of whole or part.

Cooling. Where food placed during cooling. Possible opportunities of contamination.

Health of workers previous to outbreak, especially in regard to diarrhœa; their habits as to cleanliness. What W.C. accommodation for workers (where situated and condition). Arrangements for washing hands and their use.

Collection and Examination of Materials for Bacteriological Examination

Samples collected (dates, description and quantities) of:

Food material: (*a*) Portions left over by patients, (*b*) obtained at shops, stores or places of preparation.

Clinical materials: (*a*) Blood from patients or suspected " carriers ", (*b*) post-mortem specimens.

HEADINGS OF INQUIRY INTO OUTBREAKS OF POISONING SUSPECTED TO BE DUE TO FOOD CONTAMINATED WITH INORGANIC POISONS.

What cases heard of; steps to secure complete lists of cases, e.g. inquiries of medical practitioners, neighbouring Medical Officers of Health and others.

Evidence implicating particular food or foods as cause of outbreak.

Evidence implicating any particular ingredient of the food.

Origin of the suspected food or ingredient.

Mode in which the food or ingredient became contaminated.

Inquiries in Affected Households

Names and ages of persons (*a*) in each household, (*b*) those ill, (*c*) those partaking of suspected food.

Persons affected (*a*) slightly, (*b*) seriously, (*c*) fatally; with date and hour of partaking of food in each case, and date and hour of first symptoms in each case.

Clinical character of illness.

Particular food implicated. Date of purchase; source. (The suspected food will usually be some food consumed in common by the persons affected.)

How the suspected food was prepared, and what ingredients were utilized in preparing it.

All suspected food should be secured for chemical examination. If there is any doubt as to the food implicated, all foods taken at the suspected meal and all food materials from which the foods were prepared should be carefully preserved for examination.

Source of Contamination of the Food

(1) *In the Household.*—Cooking utensils, rat poisons, drugs, &c.

(2) *On Retailers' Premises.*—Storage in proximity to poisonous articles. Examine remainder of consignment from which suspected article was supplied. Take samples for chemical examination. Examine packages or bags for evidence of staining by poisonous material, and take samples of suspicious stains for examination. Trace empty packages or bags from which the suspected food has been sold. Ascertain date of receipt of consignment, date of dispatch from wholesaler and amount received; also amount sold, dates on which portions were sold and names of purchasers.

Ascertain whence retailer obtained his supplies, the name of the firm supplying him and where the article was prepared or manufactured.

(3) *At Wholesalers' and Manufacturers' Premises.*—Method of preparation of food, opportunities for contamination, ingredients used, their origin, mode of manufacture and purity. Methods if any for controlling purity of supplies.

(4) *In Transit.*—Ascertain modes of conveyance from wholesaler to retailer and from retailer to consumer. Possibilities of contamination in delivery from retailer to consumer, e.g. in vans, carts, &c., containing poisonous substances.

Possibilities of contamination in transit by rail, lorry or barge from wholesaler to retailer. Ascertain from railway companies whether poisonous articles were packed in the same vans with suspected food.

It may be remarked that foods contaminated in the course of preparation or by the use of impure ingredients will usually contain the poisonous material, e.g. arsenic, fairly uniformly distributed throughout the food. In the case of foods contaminated in course of transit the poisonous material is commonly not uniformly distributed, e.g. a sack of sugar contaminated by a leaking can of arsenical weed-killer may contain only

a few lumps of sugar saturated with arsenic; the bulk of the sugar may remain unaffected and free from arsenic.

Specimens for Chemical Examination

In addition to the food and food materials mentioned above, specimens of vomit should be secured, and if a death occurs the stomach and stomach's contents together with a portion of the liver should be reserved for examination.

C.L. 1.

10*th August*, 1921.

APPENDIX D

MEMORANDUM (CLII) DATED 1ST APRIL, 1924, ADDRESSED TO MEDICAL OFFICERS OF HEALTH BY THE CHIEF MEDICAL OFFICER OF THE MINISTRY OF HEALTH.

Food Poisoning Inquiries

This memorandum suggests that specimens, such as those referred to in Memo 39/Foods should be sent for examination in the Ministry's Pathological Laboratory in London and continues:

Details are appended regarding the nature of samples desired, the mode of packing them, the method of applying for outfits in the case of blood specimens, and the way in which the specimens should be sent and addressed. A short note of the circumstances should in all cases accompany the specimen under separate cover.

As indicated in my previous circular letter, it is obvious that the concentration of the pathological work in one laboratory is likely to enhance considerably the value of investigations into food poisoning outbreaks as a whole, and it is hoped that in as many cases as possible Medical Officers of Health will take advantage of the present arrangement, which, like that previously made, entails no cost to local authorities. If, however, it is preferred to make or continue local arrangements for the examination of material from food poisoning cases, you will, no doubt, be prepared to assist the study of the subject in the Ministry by arranging for the pathologists of the Department to be furnished with any technical information relating to your own laboratory investigations which may be desired.

It is particularly requested that in all cases the Medical Officer of Health should send information to the Ministry by telegram or telephone at the earliest moment when an outbreak of food poisoning in his district becomes known to him. This should be observed whether specimens are sent to the Ministry or not.

COLLECTION AND TRANSMISSION OF SAMPLES

Bacterial Food Poisoning Outbreaks

Outbreaks differ so much in character that uniformity of requirement in regard to specimens is not possible, but the following should be collected:

(1) *Any Portions of the Suspected Food.*—These should be actual portions remaining over from the food which caused the illness. Even small scraps—such as the remains in tins (if a tinned food)—are better than nothing.

Samples of food of similar origin are usually of little assistance but occasionally are useful.

(2) *Post-mortem Materials from Fatal Cases.*—The spleen, pieces of liver, piece of small intestine, kidney, are the most useful. The stomach (ligatured) with unopened contents is valuable if metallic poisoning is suspected, but not of much use otherwise.

(3) *Pathological Material from the Cases.*—From all cases, and especially when (1) is not available and (2) only problematical, endeavours should be made to collect and transmit material from the actual sufferers *while in the acute stages.*

The samples should be of excreta and vomit. Of these excreta are both the easier to obtain and the more valuable.

(4) *Samples of Blood from the Sufferers for Serological Examination.*—There is no urgency about these samples since any serological reactions persist for many weeks, while in any case they will not develop until a week or more after the onset. It is better, therefore, to wait to collect these samples until after the bacteriologist has the other samples and also the preliminary information as to the outbreak, so that he can indicate exactly what he requires and send outfits if necessary.

Packing.[1]—Specimens of excreta may be sent in clean wide-mouth

[1] The following are the current Post Office Regulations regarding articles sent for Medical Examination or Analysis:

Deleterious liquids or substances, though otherwise prohibited from transmission by post, may be sent for medical examination or analysis to a recognized Medical Laboratory or Institute, whether or not belonging to a Public Health Authority, or to a qualified Medical Practitioner or Veterinary Surgeon within the United Kingdom by Letter Post, and on no account by Parcel Post, under the following conditions:

Any such liquid or substance must be enclosed in a receptacle, hermetically sealed or otherwise securely closed, which receptacle must itself be placed in a strong wooden, leather, or metal case in such a way that it cannot shift about, and with a sufficient quantity of some absorbent material (such as sawdust or cotton-wool) so packed about the receptacle as absolutely to prevent any possible leakage from the package in the event of damage to the receptacle. The packet so made up must be conspicuously marked " Fragile with care ", and bear the words " Pathological Specimen ".

Any packet of the kind found in the Parcel Post, or found in the Letter Post, not packed and marked as directed, will be at once stopped and destroyed with all its wrappings and enclosures. Further, any person who sends by post a deleterious liquid or substance for medical examination or analysis otherwise than as provided by these regulations is liable to prosecution.

If receptacles are supplied by a Laboratory or Institute they should be submitted to the Secretary, General Post Office, in order to ascertain whether they are regarded as complying with the regulations.

bottles. The food may be put in a clean tobacco tin. The organs from fatal cases should each be wrapped in a piece of clean cloth, wetted and wrung out (only damp, therefore) with 30 per cent glycerine solution. All the organs may be placed so wrapped in one large tobacco or other tin.

If possible, the samples should be sent packed in ice. An impromptu ice-box can be made by using a fairly large biscuit tin and packing the tins and bottles in one side of this, and filling the other part with dry ice in small pieces. The tins and bottles must be secured from rolling about when the ice melts by means of cloths and wood partition, or other device. The biscuit box should be packed in a wood box with at least 2 inches everywhere of sawdust between two boxes. If ice is not procurable, the samples must be sent without it rather than be delayed.

Addressing.—The samples should be marked " Urgent ", and addressed to:

Medical Department (Med. I)
Ministry of Health,
Whitehall,
London, S.W.1.

and should be sent by post or by passenger train (if more prompt delivery can be secured by the latter method). When possible, the Medical Department (Med. I) should be notified in advance.

Section VII.—Milk and Milk Products

Milk

General Composition—Adulteration—Sale of Milk Regulations, 1901—Dirt in Milk—Bacteria in Milk—Designated Grades—Modern Methods of Clean Milk Production—Hygiene of Cowhouses—Hygiene of Dairies—Procedure necessary for the Production of Clean Milk—Milk-borne Disease—Pasteurization—Pasteurizers — Supervision of Pasteurization — Summary — Milk Products.

"Milk is an almost perfect food, for although it is deficient in iron and water-soluble vitamin, it is rich in calcium and phosphorus, and supplies protein of high biological value which is of great importance in building up a sound physique and good constitution. It provides the infection-resisting and calcifying vitamins A and D, the latter mainly in summer, and generally by reason of its specific nutritive and protective qualities, is a food of special value."[1]

The importance of milk in the dietary of growing children is now generally recognized. The experiment conducted by Dr. Corry Mann showed that the addition of a pint a day of freshly pasteurized and homogenized milk to the diet of boys of school age produced an immediate improvement in physique and in general health which continued over a period of one, two, and three years.[2]

The fact that the consumption of milk in this country is far below what is desirable is frequently stressed and is undoubtedly true, but unfortunately, from the very nature of its composition, milk is peculiarly liable to become a breeding ground for micro-organisms, and raw milk is one of the vehicles by means of which infectious diseases are spread. Increased use of milk is not stimulated by the knowledge that in consuming raw milk there is a definite risk of contracting tuberculosis or some other infectious disease, and until the public can be given an assurance that the milk they are asked to drink is safe, it appears doubtful whether any substantial increase in consumption is likely to take place.

[1] *Ministry of Health Circular*, No. 1290 on Nutrition.
[2] *Medical Research Council Special Report*, No. 105.

It is clearly the duty of those concerned in the milk industry and in the maintenance of the public health to do all in their power to ensure the production of an abundant supply of clean, unadulterated, wholesome milk, of good quality and free from disease-producing bacteria.

AVERAGE PERCENTAGE COMPOSITION OF MILK

	Fat	Sugar	Proteins	Ash	Water
Cow ..	3·7	4·7	3·4	0·75	87·3
Goat ..	4·63	4·22	4·35	0·76	86·04
Human	3·4	6·4	1·7	0·3	87·2

The above figures represent the average composition of samples of milk. It will be observed that cows' milk is richer in protein, ash, and, to a less degree in fat, than human milk, while the latter excels in sugar.

Fat.—Milk fat is composed mainly of the glycerides of palmitic, oleic, and butyric acids. When milk is allowed to stand, the fat globules run together and rise to the surface in the form of cream. The cream may be removed either by hand-skimming, or, more thoroughly, by means of a centrifugal separator.

Milk intended for infant feeding is sometimes subjected to a mechanical process known as "homogenization", which reduces the fat to a fine emulsion, thus preventing the cream rising. Such milk is easily digested.

Protein.—The principal protein is casein. Lactalbumin is present in much smaller quantity than casein, constituting only about one-seventh of the total protein of cows' milk. In human milk it is relatively more abundant. Casein is clotted when acted upon by acids and rennet, while lactalbumen remains unaltered. The latter is, however, coagulated when heated to 70° C.

Sugar.—Milk contains lactose, or milk sugar, which differs from cane-sugar in its comparative freedom from sweetness. It is readily split up by the action of micro-organisms, with the production of lactic acid, a process which occurs in the souring of milk.

Salts.—The phosphates of lime and potash are present in milk and serve to build up the muscles and bone of young animals. Traces of iron (though in this respect milk is deficient) are also found, as well as citrate of calcium.

VITAMINS IN MILK

(*a*) VITAMIN A, or fat soluble vitamin, is found in the milk fat. It is believed to maintain resistance against infection, especially of the mucous membranes.

(*b*) VITAMIN B, or antineuritic vitamin (prevents beriberi).

(*c*) VITAMIN C, or antiscorbutic vitamin (prevents scurvy).

(*d*) VITAMIN D, or antirachitic vitamin, in the milk fat (prevents the development of rickets).

All these are present in small amount only; vitamin D is especially variable, being at its lowest in winter milk. The vitamin D content of milk appears to depend on the amount of fresh food which the cows consume and the sunlight to which they are exposed.

COMPOSITION AND ADULTERATION OF MILK

In common with other foods, milk is subject to the provisions of the Food and Drugs (Adulteration) Act, 1928. See p. 472, particularly paragraphs (3), (4), (5), (7) and (8). The Act also contains special provisions applying to milk. (See p. 476.)

Sale of Milk Regulations, 1901.—The effect of these Regulations is that a sample of milk containing less than 3 per cent of fat, or less than 8·5 per cent of non-fatty solids shall, for the purposes of the Food and Drugs (Adulteration) Act, 1928, be presumed, until the contrary is proved, not to be genuine by reason of the extraction of milk fat or the addition of water.

Although these limits are substantially lower than the average percentages of genuine milk, it is recognized that genuine milk may occasionally fall below one or both of the limits. Among the factors which may influence the composition of milk, the following may be mentioned:

1. BREED OF COW.—Jersey, Guernsey, and Kerry cows give most fat, Holsteins and Shorthorns an abundant supply of milk. Ayrshire and Devon cows generally give a good yield of relatively rich milk. The percentage of fat in the milk of individual animals of the same breed may vary somewhat.

2. INTERVALS BETWEEN SUCCESSIVE MILKINGS.—The percentage of fat tends to fall when a long interval has elapsed since the previous milking.

3. Age of Cow.—There is a tendency for old cows to give milk slightly inferior in quality to that of younger animals.

4. Period of Lactation.—The milk of newly calved cows should not be used during the first week after calving, on account of the presence of colostrum, which is an opaque yellow liquid sometimes containing blood. The largest amount of milk is yielded during the five months following the birth of the calf.

5. Stage of Milking.—The " fore-milk ", or that drawn during the first part of the milking, is deficient in fat, while the " strippings ", or that last removed from the udder, is very rich in fat. Incomplete milking of a cow may therefore give rise to a milk of poor quality.

6. Influence of Food.—Difference of opinion exists on the question whether the foods given to cows influence the percentage of fat contained in their milk. The results of numerous experiments carried out under varying conditions in different parts of the country show that such changes as can be effected in the composition of the milk of suitably fed cows are slight and temporary. It is probably true, however, that any method of feeding which largely increases the quantity tends to reduce the quality of the milk.

7. Day to Day Variations.—The extent to which the milk of an individual cow may vary in composition from day to day appears to be considerable. This is a matter of some importance in connexion with the practice of taking " appeal to the cow " samples at farms with the view to ascertaining whether the original sample was adulterated or naturally poor in quality. It is stated that there may be fluctuations in the amount and quality of milk yielded by cows when under the influence of sexual excitement.

8. Mixing.—It is important that the milk of a herd should be adequately mixed so that a fair average may be presented.

While it is true that, by a proper selection of cows in a milk herd, by suitable methods of milking and feeding, a mixed milk can readily be obtained which will comply with the legal standards throughout the year, nevertheless genuine milk occasionally falls below the standard, particularly if it is derived from a small herd when poor milk from one or two cows may adversely affect the quality of the bulked milk from the farm. For this reason many Local Authorities do not take proceedings unless, as a result of information derived from " appeal to the cow " samples, or otherwise, they have reason to believe that the milk has been adulterated.

In this connexion the case of Hunt *v.* Richardson is of importance. The particulars are briefly as follows:

The appellant kept cows which were milked twice daily, at 5 a.m. and 1 p.m., and nothing was added to, or abstracted from, the milk, beyond the abstraction of impurities by straining. In consequence of heavy rains the grass on which the cows were fed was in a watery condition, and they were giving a much larger quantity of milk than usual. No special steps were taken to counteract the effect of the watery state of the herbage on the quality of the milk. Although the appellant and his servant knew what was taking place, the cows were given green maize, which was even more watery, in order to keep up the quantity of milk. On an information against the appellant for selling to the prejudice of the purchaser milk not of the nature, substance, and quality demanded, the analyst's certificate showed that the milk was deficient in milk fat to the extent of 9 per cent. The justices found that the deficiency was due to the manner in which the cows were fed and they convicted the appellant.

On appeal to a higher court, however, it was held that, as the milk was genuine, the conviction must be quashed.

DIRT IN MILK

There may be no visible signs of dirt in milk and yet it may be far from clean. The wholesomeness, as well as the keeping quality, largely depends upon the bacterial content of the milk, which, in turn, depends upon the conditions under which it is produced. Though it may be contaminated in transit, or in the course of delivery, it is in the cowshed, during the process of milking, that dirt, which is largely manurial in origin, is most liable to gain access to milk. A considerable amount of this dirt becomes dissolved and cannot be removed by straining or by any other means. Once the entry of dirt has been effected the deleterious effects resulting therefrom cannot be eradicated, and the contained bacteria become disseminated throughout the whole supply with which the contaminated milk is mixed.

Unclean milk utensils, which may contain small quantities of milk and milk residues in which bacteria flourish, are another very important source of contamination. It is essential, therefore, for the production of clean milk, that the utensils should not only be scrupulously clean but that they should be sterilized by steam before being used for any purpose in connexion with milk. Further, as milk forms an admirable breeding ground for micro-organisms in which they multiply very rapidly under suitable conditions, all

practicable measures should be adopted, not only to reduce the number entering the milk, but to inhibit the growth of those which have gained access to it. The latter object may be attained by cooling the milk immediately after milking, and by keeping it at as low a temperature as practicable until it is consumed.

The amount of dirt contained in milk may be estimated by subjecting a sample to centrifugalization and weighing the residue, but, as the amount recovered by this means is only a fraction of the original quantity, much of which remains in the milk in a condition of solution or suspension, such estimates are of relatively little value. A more reliable guide is the number of bacteria found on bacterial investigation of a sample, and the degree of contamination is generally expressed in terms of the bacterial content of the milk.

The " designated milks " are required to comply with bacterial standards. (See p. 355.) Thus " Certified Milk " must not contain more than 30,000 organisms per cubic centimetre, and no coliform bacillus in one-tenth of a cubic centimetre. The latter organism is generally derived from cows' dung.

BACTERIA IN MILK

The number of bacteria contained in milk is generally accepted as an index of its fitness for human food. While in the udder of a healthy cow milk contains few, if any, bacteria, but as soon as it is drawn from the teat it is exposed to contamination from many sources, i.e. from the cow, the milk pail, the hands and clothing of the milker, the dust in the air of the cowshed, &c. The flora of milk is therefore largely dependent on the circumstances and environment in which it is produced and handled.

Large numbers of organisms are always present in milk however carefully it is handled, and, as milk forms a good medium for growth, they rapidly increase in number. The bacteria commonly found in milk are non-pathogenic (non-disease-producing) organisms. The presence of an undue number of such organisms indicates that the milk has not been produced and handled in a cleanly manner. The bacteria may impair the keeping quality of the milk or cause undesirable changes in its taste or odour.

But milk may contain pathogenic (disease-producing) bacteria derived either from the cow or from persons engaged in the production or handling of the milk. (See Milk-borne Diseases, p. 381.)

It is important to distinguish clearly between a "clean" and a "safe" milk, as it is often erroneously assumed that the terms are synonymous. A "clean" milk is free from extraneous matter (dirt, manure, pus, blood, &c.), and does not contain an undue number of organisms. A "safe" milk is one which contains no *pathogenic* bacteria. An "unclean" milk, though undesirable, may be safe to drink, whereas a milk, however clean, which contains pathogenic bacteria is dangerous.

DESIGNATED MILKS

The Milk (Special Designations) Order, 1923, and the Milk (Special Designations) Order (Scotland), 1930, were made under Section 3 of the Milk and Dairies (Amendment) Act, 1922.

Both the English and Scottish Orders provide for the following official grades of milk:

(*a*) "Certified" (the highest grade); (*b*) "Grade A (Tuberculin Tested) (the second grade); (*c*) "Grade A" (the third grade); (*d*) "Grade A Pasteurized"; and (*e*) "Pasteurized".

The following Memorandum (Memo. 77, Foods) issued by the Ministry of Health sets out in general terms the effect of the Milk (Special Designations) Order, 1923.

PART I.—GENERAL

1. The special grades of milk to which this memorandum relates may be shortly described as follows:

Certified Milk is raw milk from cows which have passed a veterinary examination and a tuberculin test; it is bottled on the farm; and it does not contain more than 30,000 bacteria per c.c. or any coliform bacillus in 1/10th c.c.

Grade A (Tuberculin Tested) Milk is raw milk from cows which have passed a veterinary examination and a tuberculin test; it is bottled either on the farm or elsewhere; and it does not contain more than 200,000 bacteria per c.c. or any coliform bacillus in 1/100th c.c.

Grade A Milk is milk from cows which have passed a veterinary examination. It is bottled either on the farm or elsewhere; it may be raw or pasteurized; if raw it does not contain more than 200,000 bacteria per c.c. or any coliform bacillus in 1/100th c.c.; if pasteurized it is described as *Grade A Milk Pasteurized* and does not contain more than 30,000 bacteria per c.c. or any coliform bacillus in 1/10th c.c.

Pasteurized Milk is milk which has been retained at a temperature of 145° to 150° F. for at least thirty minutes; and does not contain more than 100,000 bacteria per c.c.

2. It is unlawful to use any of these designations or any similar designation for milk except in accordance with a licence granted by the Minister of Health or by a Local Authority.

3. The Licensing Authorities and the annual fees payable for the various classes of licences are set out in the table below. Licences expire on the 31st December and where a licence runs for a part of the year only a reduced fee may be payable.[1]

Designation	Premises	Licensing Authority [2]	Annual Licence Fee £	s.	d.
Certified ..	Farm	Minister of Health	5	0	0
	Other premises ..	Sanitary Authority [3]	0	5	0
Grade A .. (Tuberculin Tested).	Farm at which milk is bottled.	Minister of Health	3	3	0
	Farm at which milk is *not* bottled.	" "	1	1	0
	Bottling establishment not on farm.	Sanitary Authority [3]	2	2	0
	Other premises ..	" "	0	5	0
Grade A ..	Farm at which milk is bottled.	County Council (or County Borough Council) [4]	3	3	0
	Farm at which milk is *not* bottled.	" "	1	1	0
	Bottling establishment not on farm.	Sanitary Authority [3]	2	2	0
	Other premises ..	" "	0	5	0
Pasteurized ..	Pasteurizing establishment.	" "	1	1	0
	Other premises in another district.[5]	" "	0	5	0

4. The general rule is that a licence applies to one grade of milk and one establishment, so that where a person deals in more than one grade or sells from more than one establishment separate licences are required

[1] Licences are required in the case of either "Certified, Grade A (TT) or Grade A milk" both by the farmer who produces the milk and by every dealer who sells it. In the case of "Pasteurized Milk" a licence is required by the person who pasteurizes it and by any other dealer who sells it.

[2] In Scotland, all licences (for producers and distributors) are granted by County Councils and rhe Town Councils of certain Boroughs.

[3] I.e. the Council of a Borough (including a Metropolitan Borough) or of an Urban or Rural District.

[4] In a few areas the granting of Producers' Licences for Grade A Milk has been transferred from the County Council to the Sanitary Authority.

[5] See paragraph 4 (*c*) below.

and separate fees are payable. This rule is subject to the following exceptions, viz.:

(*a*) A producer of Certified Milk may sell the milk as " Grade A (Tuberculin Tested) " or " Grade A " without any further licence.

(*b*) A producer of Grade A (Tuberculin Tested) Milk may sell the milk as " Grade A " without any further licence.

(*c*) A person holding a licence in respect of a Pasteurizing establishment may sell the milk as " Pasteurized " from any premises in the same district without any further licence.

(*d*) Where a producer or dealer licensed by a County Council or other Local Authority delivers milk direct from the establishment specified in his licence to retail purchasers outside the area of that Authority it is necessary for him to obtain a Supplementary Licence (for which the annual fee is 2*s*.) from the Sanitary Authority of the district in which the milk is so delivered.

5. Every licensee must keep accurate records in such a way that they can conveniently be checked. The records must show the quantities of milk produced, purchased and sold as the case may be, and the names and addresses of the persons from whom it is purchased and of the persons to whom it is sold otherwise than by retail.

6. Milk sold under a special designation must be kept separate at all stages from all other milk.

7. Before a licence is granted the applicant must satisfy the Licensing Authority that the prescribed conditions will be regularly complied with. For this purpose the Licensing Authority may direct an inspection of the farm or other establishment in respect of which the licence is desired and may require the applicant to submit reports on the bacteriological examination of samples of milk taken under specified conditions. Every facility must be given at all times to any person authorized by the Licensing Authority to inspect the premises, processes of production, equipment, methods and records and to take samples of the milk (free of charge).

8. The requirements of the Milk and Dairies Order apply to persons dealing in graded milk in the same way as they apply to other cowkeepers and dairymen. The only specific requirements as to the condition of premises are those which are contained in that Order, and if it is proposed to make any alterations to premises for the purpose of facilitating the production of clean milk or for other reasons the Sanitary Authority should be informed in order to ensure that the altered premises will be in accordance with those requirements.

9. Any further information as to the conditions governing the granting of licences can be obtained from the Ministry of Health or from the appropriate Licensing Authority. A producer who requires technical advice as to the steps to be taken to produce milk complying with the

prescribed conditions is recommended to consult the Agricultural Organizer for the County in which his premises are situated.

PART II.—CERTIFIED MILK

The special [1] conditions under which licences are granted for the sale of Certified Milk are:

1. The milk must be the milk of healthy animals which have passed the tuberculin test. For this purpose:

(*a*) Every animal in the herd must pass a veterinary examination and a tuberculin test as described in the Appendix to this memorandum within three months before the date of the application for the licence, and thereafter at intervals of six months.[2] Tuberculin must not be used except for the purpose of the required tests.

(*b*) The examination and test must be carried out by a veterinary surgeon approved by the Ministry.

(*c*) Any animal which fails to pass the tuberculin test must immediately be removed from the herd and must not be reintroduced. Any animal found to be showing evidence of any disease which may affect the milk injuriously must immediately be removed from the herd or isolated, as the case may require, and must not be reintroduced until certified by a Veterinary Surgeon as having recovered. The milk of the animals so removed or isolated must not be sold as milk from the herd.

(*d*) Every new animal introduced into the herd must pass the tuberculin test immediately before admission unless it is a non-reactor taken directly from some other licensed tuberculin-tested herd.

(*e*) The herd must be kept completely isolated from all other cattle.

(*f*) A herd book or register of all the animals in the herd (showing additions and removals) must be kept and all the animals must be suitably marked for purposes of identification (e.g. with numbers tattooed on the ear or branded on the horn).

(*g*) The reports on the veterinary examinations and tuberculin tests must be sent to the Ministry within seven days. Where an animal is removed from the herd or isolated in pursuance of paragraph (*c*) above the Ministry must also be informed of the reasons for the removal or isolation and, in the case of removal, of the manner in which the animal has been disposed of.

2. The milk must be bottled on the farm immediately after production for delivery to the consumer. Every bottle must be securely closed and

[1] See also the general conditions in Part I. [2] Not less than three times a year in Scotland.

sealed with a cap overlapping the lip of the bottle. The cap must bear:

(i) the name and address of the producer, or of the farm;
(ii) the day of milking; and
(iii) the words " Certified Milk ".

The words " produced from cows which have passed the tuberculin test " may be added, but no other words may be placed on the cap, except with the consent of the Ministry.

3. (*a*) The milk at any time before delivery to the consumer must not contain more than 30,000 bacteria per c.c. or any coliform bacillus in 1/10 c.c.

(*b*) Experience shows that in order to ensure compliance with this condition throughout the whole of the year it is necessary to make provision for the steam-sterilization of all utensils and containers.

4. The milk must not at any stage be treated by heat.

PART III.—GRADE A (TUBERCULIN TESTED) MILK

The special [1] conditions under which licences are granted for the sale of Grade A (Tuberculin Tested) Milk are:

1. The milk must be the milk of healthy animals which have passed the tuberculin test. For this purpose the rules (*a*) to (*g*) set out in paragraph 1 of Part II (Certified Milk) apply.

2. (*a*) Except as stated in paragraph (*d*) below the milk must be delivered to the consumer in bottles filled at the farm or at some other licensed bottling establishment.

(*b*) If the milk is not bottled on the farm it must be sent to the bottling establishment in unventilated sealed churns, each churn being suitably labelled with the following particulars:

(i) The address of the farm.
(ii) The day of milking and the word " morning " or " evening " according to the time of milking. (E.g. Monday morning, Monday evening.)
(iii) The words " Grade A (Tuberculin Tested) Milk ".

(*c*) Every bottle in which the milk is delivered to the consumer (whether filled at the farm or elsewhere) must be securely closed and sealed with a cap overlapping the lip of the bottle. The cap must bear:

(i) The name of the dealer by whom the milk was bottled.
(ii) The address of the bottling establishment.
(iii) The words " Grade A (Tuberculin Tested) Milk ".
(iv) The day of milking.

[1] See also the general conditions in Part I.

Except with the consent of the Licensing Authority for the bottling establishment no other words may be placed on the cap.

(*d*) For delivery to large consumers the milk instead of being bottled may be sent in containers of at least two gallons capacity, each container being closed with a tightly fitting cover and suitably sealed and labelled (see paragraph 2 (*b*) above).

3. (*a*) The milk at any time before delivery to the consumer must not contain more than 200,000 bacteria per c.c. or any coliform bacillus in 1/100 c.c.

(Where the producer sends the milk to a bottling establishment, it should, of course, on arrival at that establishment, be capable of satisfying a much stricter test both as to the number of bacteria per c.c. and as to the presence of coliform bacillus.)

(*b*) Experience shows that in order to ensure compliance with this condition throughout the whole of the year it is necessary to make provision for the steam-sterilization of all utensils and containers.

4. The milk must not at any stage be treated by heat.

PART IV.—GRADE A MILK

The special[1] conditions under which licences are granted for the sale of Grade A milk are:

1. The milk must be the milk of healthy animals. For this purpose:

(*a*) Every milch cow in the herd must pass a veterinary examination as described in the Appendix to this memorandum within a month before the date of the application for the licence, and thereafter at intervals of three months.

(*b*) The examination must be carried out by a veterinary surgeon nominated by the Licensing Authority.

(*c*) Any cow found to be showing evidence of any disease which is likely to affect the milk injuriously must immediately be removed from the herd or isolated as the case may require and must not be reintroduced until certified by a veterinary surgeon as having recovered. The milk of any such cow must not be sold as "Grade A".

(*d*) The herd must not include any animal which to the knowledge of the owner has at any time reacted to the tuberculin test.

(*e*) The cows in milk belonging to the herd must be kept separate from all other cows in milk.

(*f*) If tubercle bacillus is at any time found in the milk the producer must ascertain which animals are diseased and remove them from the herd.

[1] See also the general conditions in Part I.

(g) A herd book or register of all the milch cows in the herd (showing additions and removals) must be kept and all those cows must be suitably marked for purposes of identification (e.g. with numbers tattooed on the ear or branded on the horn).

(h) The reports on the veterinary examinations must be sent to the Licensing Authority within seven days and where a cow is removed from the herd or isolated in pursuance of paragraph (c) that Authority must also be informed of the reasons for the removal or isolation and, in the case of removal, of the manner in which the cow has been disposed of.

2. The rules (a) to (d) as to the bottling and delivery of Grade A (Tuberculin Tested) Milk contained in paragraph 2 of Part III apply to Grade A Milk with the omission of the words " Tuberculin Tested " from the labels and bottle caps.

3. (a) The milk at any time before delivery to the consumer must not contain more than 200,000 bacteria per c.c. or any coliform bacillus in 1/100 c.c.

(Where the producer sends the milk to a bottling establishment it should, of course, on arrival at that establishment be capable of satisfying a much stricter test both as to the number of bacteria per c.c. and as to the presence of coliform bacillus.)

(b) Experience shows that in order to ensure compliance with this condition throughout the whole of the year it is necessary to make provision for the steam-sterilization of all utensils and containers.

4. (a) The milk must not be treated by any heating process other than pasteurization carried out in accordance with the conditions specified in Part V of this memorandum and if it is so pasteurized it must be sold and labelled as " Grade A Milk Pasteurized ".

(b) Grade A Milk Pasteurized at any time before delivery to the consumer must not contain more than 30,000 bacteria per c.c. or any coliform bacillus in 1/10 c.c.

PART V.—PASTEURIZED MILK

The special[1] conditions under which licences are granted for the sale of Pasteurized Milk are:

1. The milk must be retained at a temperature of not less than 145° and not more than 150° F. for at least 30 minutes and then immediately cooled to a temperature of not more than 55° F.

2. It must not be otherwise treated by heat and must not be pasteurized more than once.

[1] See also the general conditions in Part I.

3. The type of apparatus and the methods employed must be satisfactory to the Licensing Authority.

4. *The milk at any time before delivery to the consumer must not contain more than 100,000 bacteria per c.c.*

5. Every receptacle containing the milk must be suitably labelled "*Pasteurized Milk*".

APPENDIX

I.—Veterinary Examination

For Certified, Grade A (Tuberculin Tested) and Grade A Milks.

The animals must be examined for the following pathological conditions, viz.:

> Tuberculosis of the Udder, Indurated Udder, Enlargement of Supra-Mammary Lymphatic Glands, Tuberculosis in any form with Emaciation, Chronic Cough with definite Clinical Symptoms of Tuberculosis, Anthrax, Foot-and-Mouth Disease, Mastitis, Abscess of the Udder, Retained Placenta, Actinomycosis of the Udder, Suppuration of the Udder, Any Comatose Condition, Any Septic Condition of the Uterus, and Any Infection of the Udder or Teats, which is likely to convey Disease.

In the case of Certified and Grade A (Tuberculin Tested) Milks every animal in the herd, including any bulls which are kept in contact with the cows while they are in milk, must be examined. In the case of Grade A Milk it is only necessary to examine the milch cows.

For Grade A Milk the Certificate should be in the following form:

Certificate

Name of owner of herd

Address of farm or premises

Post Town County

Total number of cows and heifers in herd

Total number of milch cows in herd

I have this day examined all the animals described in the Schedule (below) (overleaf) being all the milch cows in the above herd and after submitting each animal separately to a clinical examination, I Certify that no animal is affected with or shows symptoms indicative of any of the following pathological conditions:

Tuberculosis of the Udder, Indurated Udder, Enlargement of Supra-Mammary Lymphatic Glands, Tuberculosis in any form with Emaciation, Chronic Cough with definite Clinical Symptoms of Tuberculosis, Anthrax, Foot-and-Mouth Disease, Mastitis, Abscess of the Udder, Retained Placenta, Actinomycosis of the Udder, Suppuration of the Udder, Any Comatose Condition, Any Septic Condition of the Uterus, and Any Infection of the Udder or Teats, which is likely to convey Disease:

with the exception of the [1] animals indicated.

Signature of Veterinary Surgeon

Address

Date 193 .

SCHEDULE

Identification Mark	Pathological Condition as specified in Certificate	Degree. (Very Marked, Marked, Slight)

GENERAL REMARKS

[1] Here insert number. If none, delete this line.

II.—Tuberculin Test

For Certified and Grade A (Tuberculin Tested) Milks.

The Test must be the double intradermal test.

The method of carrying out the double intradermal test is described in a memorandum by the Tuberculin Committee of the Medical Research Council, copies of which may be purchased from H.M. Stationery Office.

Forms for reporting the results of The Veterinary Examination and the Double Intradermal Test are supplied by the Ministry.

MILK (SPECIAL DESIGNATIONS) ORDER (SCOTLAND), 1930

This Order is generally similar to the Milk (Special Designations) Order, 1923, in operation in England and Wales. The following differences may, however, be noted:

(*a*) In England and Wales producers' licences for Certified and Grade A (Tuberculin Tested) Milks are granted by the Central Health Authority (the Ministry of Health). In Scotland all licences under the Order are granted by Local Authorities.

(*b*) In Scotland the Local Authorities may, at their discretion, reduce the licence fees specified in the Order.

(*c*) In Scotland all milk sold as Certified, Grade A (Tuberculin Tested) or Grade A is required to contain at least 3·5 per cent butter fat.

(*d*) In Scotland all animals in licensed herds must be clinically examined at least three times a year. (In England and Wales animals in Grade A herds must be clinically examined four times a year, and animals in Certified and Grade A (Tuberculin Tested) herds twice a year).

(*e*) In Scotland it is provided that if after two prescribed tuberculin tests no reactor has been found on either occasion, and no animal has been introduced into the herd (other than an animal taken directly from a licensed Certified or Grade A (Tuberculin Tested) herd subsequent tuberculin tests shall be required only at intervals of 12 months. There is no similar provision in the English Order.

SAMPLING OF GRADED MILK

Memorandum 139, Foods, issued by the Ministry of Health, relates to bacteriological tests for graded milk, and contains the following recommendations as to the taking and packing of samples of milk intended for bacteriological examination.

Where the milk to be sampled is contained in bottles, each sample should consist of one bottle (with seal unbroken) taken any-

where between the place of bottling and the consumer. Where the milk to be sampled is not contained in bottles, samples should be taken and dispatched in specially sterilized four-ounce or six-ounce bottles, each bottle being properly fastened and sealed.

On collection the bottles must be transferred forthwith to a carrying-case and well packed in ice, and must be kept in this condition until plated at the laboratory. (This precaution may be dispensed with only if the bacteriologist considers it unnecessary on account of the proximity of the laboratory to the place in which the samples are collected.)

MODERN METHODS OF CLEAN MILK PRODUCTION

Considerable attention has been devoted in recent years to the methods by which clean milk may be secured, and, by means of "clean milk competitions" and otherwise, farmers have been encouraged to practise them. In this connexion, Dr. Thomas Orr, in an admirable paper on the pasteurization of milk, stated:[1] "Undoubtedly there has been a marked improvement in the cleanliness of the milk supplied to the consumer in the last ten years. The interest of the public, the education of the farmer and distributor and keen commercial competition have had a much greater influence than legislation. The earliest successful attempt to produce an ideal milk, which is a clean and pure raw milk, was in 1908, by Mr. Wilfred Buckley, to whom we owe a great debt of gratitude for his practical and sustained efforts in the cause of clean milk. He freed his dairy herd from tuberculosis by means of the tuberculin test, and in that year produced for sale milk of the highest bacterial quality from tuberculin-tested stock. He was followed in 1909 by Dr. (now Sir John) Robertson, who, as Medical Officer of Health for Birmingham, managed to persuade his council to offer practical assistance to the farmers situated within 10 miles of the city, in the way of tuberculin-testing and technical advice in getting their dairy herds freed from tuberculosis. The War unfortunately interrupted this valuable and instructive experiment.

"Since then the National Institute for Research in Dairying at Reading, under the keen and capable guidance of Dr. Stenhouse Williams, whose untimely death we all deplore, has in a remarkable

[1] "Is Pasteurization the Solution of the Milk Problem?", by Thos. Orr, M.D., D.Sc., M.O.H., Ealing, *Public Health*, August, 1932, p. 326.

way been able to encourage many farmers to adopt cleanly methods of production and to test their stock with tuberculin.

"The Ministry of Health, by its support and encouragement of grading, which has had a great educative effect; the Ministry of Agriculture, by its various methods of imparting instruction and of giving advice to farmers, and many other bodies and individuals have all been active in the campaign for a wholesome milk supply."

The good work done by the Midland Counties Dairies, Ltd., Birmingham, demonstrates the great improvement in the cleanliness of milk that may be effected by those in the milk industry. Having established a bacteriological laboratory in 1922, the following procedure was adopted by the firm: (*a*) regular examination was made of the farmers' milk as it came into the depot; (*b*) advice was given on the farm when the necessity arose; and (*c*) an extra price was paid to a certain proportion of the farmers supplying the cleanest milk.

The results attained were striking. In 1922 only 4·9 per cent of the farmers were able to supply milk with an average bacteriological count of less than 10,000. In 1929, the percentage had risen to 60. In 1922, 54·5 per cent of the farmers were sending in milk with a count of less than 200,000; in 1929, 89 per cent accomplished this result.

Before discussing the procedure necessary for the production of clean milk, it may be desirable to consider the hygiene of cow-houses and dairies.

HYGIENE OF COW-HOUSES AND DAIRIES

Cow-houses

The requirements of the Milk and Dairies Order, 1926, in respect of the construction of cow-houses, are not specifically defined, with the result that cow-houses of widely different types may fulfil the requirements of the Order provided they afford efficient light and ventilation, and are constructed and arranged with due regard to the attainment and maintenance of cleanliness.

The condition of the cow-houses in some parts of the country still leaves much to be desired. They are not infrequently dark, ill-ventilated, insanitary buildings, with few windows and no adequate system of ventilation. The internal surfaces of the walls may be rough, uneven, and smeared with dirt; the floors, lacking in adequate

fall, may be badly laid with unsuitable materials, or paved with uneven and broken flagstones so that they cannot be maintained in a cleanly condition. The midden is sometimes situated within a few feet of the cow-house door.

Such dark, warm, ill-ventilated, and too often dirty cow-houses provide suitable conditions for the spread of tuberculosis from cow to cow, and, whatever preventive measures may be adopted, so long as cows are kept in such insanitary surroundings, eradication of the disease will be difficult or impossible.

Cow-houses should be designed to provide healthy conditions for the cows, to afford all necessary facilities for cleanliness, and to reduce to a minimum the labour involved in all branches of the work. While clean milk can be produced in the old type of cowshed, its production is greatly facilitated in one of modern design and construction. It should be added that much may often be done at relatively small expense to improve old and unsatisfactory cow-houses, and the general principles outlined below may be of assistance in connexion with the modernizing and remodelling of existing buildings.

Some farms are equipped with a shed which is used for no purpose other than milking. Such an arrangement is ideal, as it facilitates cleansing of the cows and decreases the danger of contamination of the milk. In districts where litter is plentiful and of small commercial value, satisfactory housing may be provided in a covered yard if there is, in addition, a suitably constructed milking shed.

In the Hosier system the cows are left out day and night. They are milked by means of a milking machine in a small shed provided for the purpose. Among the advantages claimed for this system are that it costs less, as one man and a boy can milk and feed 60–70 cows, the milk is clean, and the cows healthier, the occurrence of tuberculosis being rare. The system is particularly applicable to dry districts where damp, chilling mists are rare and bogland absent.

On the majority of farms, however, the cows are housed for the greater part of the winter, and the notes which follow apply to cow-houses intended for this purpose.[1]

General Considerations.—The site on which the cow-house is built should be dry, sheltered from prevailing winds, and moder-

[1] These notes are to a large extent based on the recommendations contained in the Ministry of Agriculture and Fisheries Bulletin, No. 40, on the Construction of Cow-houses, and in " The Production and Distribution of Clean Milk ", by A. T. R. Mattick, B.Sc.

ately high in relation to the level of the surrounding ground, so as to afford a suitable fall for drainage. To obtain the maximum of sun and light, particularly in the rear of the cows, single-range buildings (intended for one row of cows) should be sited, with the long axis east and west (the heads of the cows being to the north and their tails to the south), while, in the case of a double-range house (for two rows of cows) the long axis should run north and south.

In building a new cow-house, it is convenient to provide a mixing floor, where the cows' food can be prepared, under the same roof, but separated from, the cow-house.

Too often farm buildings are so arranged as to necessitate the cows approaching the cow-house across a manure yard. This is most undesirable, and, as cleanliness is the first essential, a clean dry approach is a *sine qua non*. There should be nothing fostering the presence of dust or flies in the vicinity of the cow-house or dairy, and access from the former to the latter should be remote from all sources of possible contamination. It is further desirable to provide three ways of entrance and exit to and from the cow-house, namely: (*a*) for the entrance of cows and the removal of dung; (*b*) for access to the fodder and mixing room; and (*c*) for the conveyance of milk to the milk room or dairy.

Different Forms of Cow-house.—Single or double-range cow-houses may be equally efficient. A single-range house is suitable for about fifteen cows, for a larger number a double-range house is preferable. Fig. 1 illustrates different forms of the latter. Perhaps the commonest is that in which the cows stand on each side of a central passage with their heads close to the side walls (A). In (B) the cows face one another across a central feeding passage, while a milking passage or gangway is situated on each side of the building at the rear of the cows. This form of house is not hygienic, as the cows are liable to cough in one another's faces, thus perhaps leading to spread of infection, and the animals' heads are far removed from the windows and fresh-air inlets on the sides of the building. In (C) the cows face the side walls, with a feeding passage intervening between the wall and the heads of the cows. This provides free circulation of air about the animals' heads which is very beneficial. A milking passage, or gangway, runs down the centre of the building. This form of cow-house has much to recommend it.

Dimensions.—With the view of facilitating cleanliness, the length of the standing should vary according to the breed of the cow. It ought to

be of such a length as to admit of the cow defecating into the channel behind and not upon the standing. If too short, the cow will stand with her hind-feet in the manure channel. If too long, the animal will defecate upon the standing, with the result that her hind-quarters, or udder, will be soiled when she lies down, thus increasing the labour involved in maintaining reasonable cleanliness. If double stalls are too narrow, when one of the cows lies down the other may tread on her legs, udders or teats, and injury may result. If too wide, the cows may turn round and drop urine or excrement in the trough or on the floor of the stall. The latter may be obviated by fixing a galvanized iron tubular division between each cow.

"In calculating the standings, 3 ft. 6 in. in width should be allowed for each cow, and it is not generally convenient to range more than 12 cows without a cross passage at least as wide as a standing."[1]

The length of the standing may vary somewhat according to the method of tying. When the tyings employed keep the cows well forward, the length of the standing may be diminished by about 6 in.

"For average Shorthorns, large Guernseys and breeds of similar size, the length of the standing from manger to step should fall within the limits of 4 ft. 9 in. to 5 ft. 3 in., with 5 ft. as the most usual length for yoke or similar close tyings, and 5 ft. 3 in. to 5 ft. 6 in. for old-fashioned single-chain ties, while the width of the trough should occupy at least 3 ft., with yoke tyings, and 2 ft. 6 in. for the single-chain ties. These dimensions

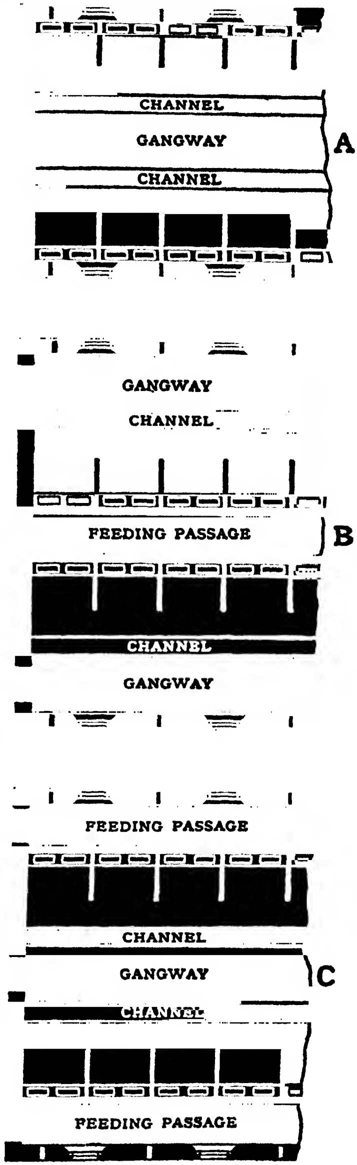


Fig. 1.—Types of Byre

[1] Ministry of Agriculture and Fisheries Bulletin, No. 40.

require that the height of the trough beneath the cow's neck shall not be more than 8 in."[1]

"It will be seen that at least 7 ft. 9 in. is required in the width of the

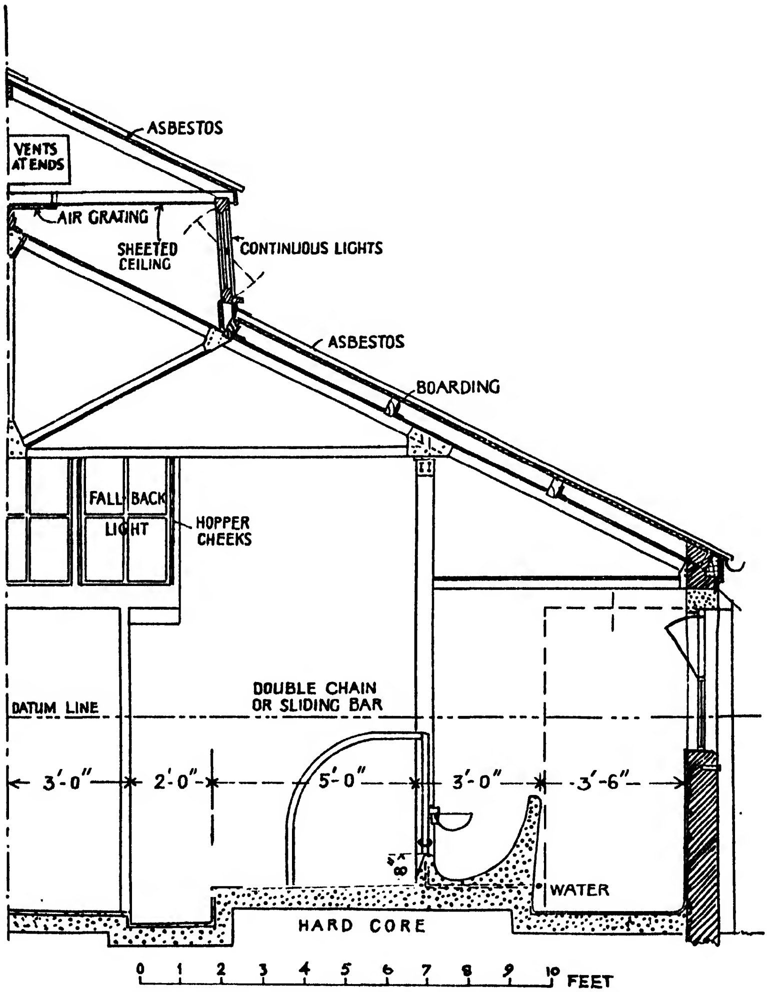


Fig. 2.—Section of half of Double-range Cow-house (third type)
Reproduced by permission of H.M. Stationery Office

building for standing and trough together. A minimum width of 1 ft. 6 in. or preferably 2 ft. is required for the dung channel, and 4 ft. 6 in. for the back gangway, giving a total minimum width across a new single-range cow-house of 13 ft. 9 in. In adapting old buildings it may be possible,

[1] Ministry of Agriculture and Fisheries Bulletin, No. 40.

in extreme cases and for very few cows, to utilize an existing width of 13 ft., but this is an absolute minimum and is not really satisfactory. In such cases the usual dung channel may be omitted and a half-round gutter formed at a distance of 2 ft. from the edge of the standing, the paving on each side being given a fall towards the gutter. With anything less than 13 ft. in width an extension of the building is essential." [1]

The standings should slope from the manger to the dung channel so as to facilitate cleansing.

Feeding passages, where included, should occupy at least 3 ft. 6 in., giving 17 ft. 6 in. as a convenient width for single-range buildings. When the feeding passage is central in a double-range cow-house the minimum width should be 5 ft. All feeding passages should have direct access to the fodder room. The double-range cow-house (tail to tail) will require a central gangway from 5 ft. to 6 ft. wide, giving 33 ft. over all as a proper width, with 31 ft. 6 in. as a minimum.

It will be understood that with all these dimensions, except the length and width of the standing, in which an increase is actually detrimental, a few inches extra is all to the good, if circumstances permit. Thus a feeding passage 4 ft. instead of 3 ft. 6 in. in width is preferable, especially where a barrow is used, and, in large houses, increase in the width of the milking passages or gangways may be desirable to enable a dung cart to be drawn through with ease.

" The height of the eaves will naturally be governed by the doors and their lintels, while the roof will be carried to the height suitable to the construction and materials employed—always provided that the light and ventilation are satisfactory." [1]

FLOORS.—The floors should be made of cement concrete. Before it is laid, care should be taken that the ground is even throughout, well rammed and uniformly firm. Upon this a foundation of coarse concrete (not less than 4 in. thick) should be laid, finished on the surface with a mixture (1 in. in thickness) composed of crushed granite (2 parts) and cement (1 part). Alternatively, a layer of 4 in. hardcore, well rammed, may form the foundation, with a flooring composed of a mixture of granite and cement, in the above proportions, laid on the top. The surface, while it is still soft, should be slightly roughened with a stiff broom to render the floor less slippery.

With the view of protecting the cows' knees, a space in front of the manger is sometimes paved with rammed clay or chalk, but such substances do not provide a very satisfactory flooring from the point of view of cleanliness, and they require frequent attention. The warmth and comfort of the standings is said to be increased if the concrete upon their surfaces is laid upon some material affording ample air spaces, such as hollow building blocks, drain tiles or pipes, &c.

[1] Ministry of Agriculture and Fisheries Bulletin, No. 40.

FEEDING TROUGHS may be made of smooth cement concrete, or standard sections in glazed piping are obtainable. The trough should be continuous for 10 or 12 cows, so that it may be easily washed down and, with this end in view, a slight fall and an outlet at the lower end facilitate cleansing. In order to afford sufficient headroom for the cows, the trough should be at least 2 ft. 6 in. in width when it is placed against the wall, and single chain tying is in use. Where yoke fittings are employed, and there is a feeding passage, the trough should have the following dimensions, namely, width 3 ft., height at back 2 ft. 6 in., and in front not more than 8 in. in the centre.

Each animal should have its own drinking water basin.

THE DUNG CHANNEL should, if possible, be 2 ft. in width, so as to admit a brush and shovel, and never less than 18 in. A slight slope away from the cow is an advantage in addition to the general fall of $1\frac{1}{2}$ in. per 10 ft. length. The channel, which should be formed of hard concrete finished smooth, should have vertical sides, the depth next to the standing being 10 in. and, on the gangway side, 4 in. (the floor of the gangway being lower than that of the standing). The channel should drain to a trapped gully outside the cow-house. No buried or inaccessible drains nor inside traps should be permitted.

DIVISIONS.—Wooden partitions, which are difficult to clean, should not be used, and those of concrete, slate or stone are not very satisfactory as they also are difficult to clean, and they impede the free circulation of air. From the hygienic point of view the use of steel tubular divisions and stanchions are preferable to anything else, and there should, if possible, be a division for each cow. (See fig. 3.)

TYINGS.—The old-fashioned single chain tying, with cows in pairs,

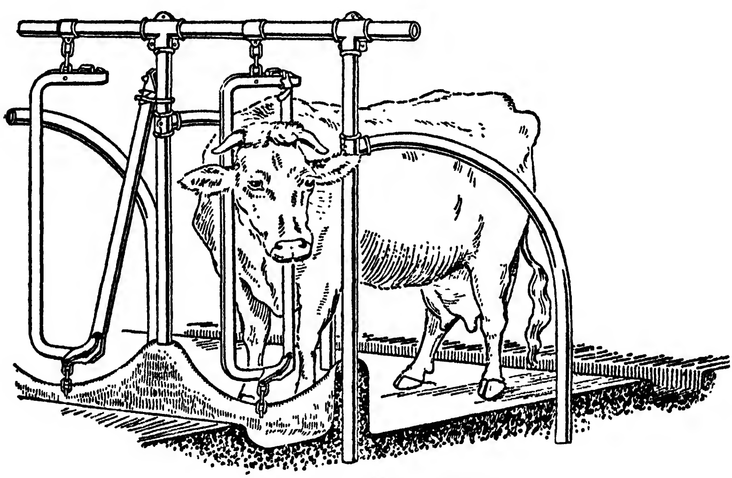


Fig. 3.—Modern Method of Tying

is not to be recommended, as it gives the cow too much freedom of movement which frequently results in soiling of the standing. Use of the yoke stanchion fitting illustrated in fig. 3 or similar close tyings are preferable. These hold the cow well forward, and, as already stated, the standings may be made about 6 in. shorter on that account.

HAYRACKS are found in many of the older cow-houses, sometimes with a loft above. They are most undesirable as they give rise to dusty conditions of the atmosphere. The wider troughs and modern systems of tying obviate their necessity.

WALLS.—Cow-houses may be erected of stone, brick, concrete, wood, or wood and iron; the two latter are not suitable for the purpose. If of stone or brick, the walls should be neatly pointed and faced on the inside with cement, finished smooth, to a height of 4 ft. 6 in. from the floor. The walls above the cement dado can be kept in good condition by frequent spraying with limewash. Whatever the construction of the cow-house, it is essential that the internal surfaces of the walls should be hard, impervious, and easily cleansed.

ROOF.—Slates or tiles are the best roofing materials. Galvanized iron is not to be recommended as it gives rise to fluctuations of internal temperature and to a large degree of condensation. It should never be used without an underlining. Asbestos cement in the form of slates, tiles, or sheets are relatively inexpensive, and may be used without an underlining, though they are improved by having one.

All roofs should be open to the ridge; a loft above a cow-house is always objectionable. In the construction of the roof the use of heavy dust-collecting timbers and tie beams should be avoided as adequate trusses may be built up of lighter scantlings, spiked and bolted at joints and crossings, but light steel supporting structures are best.

SPACE—The Milk and Dairies Order, 1926, does not prescribe standards of floor and cubic space, and, though height and space, however liberal, cannot obviate the necessity for ventilation, nevertheless, if an adequate supply of fresh air without draught is to be provided, questions of height and space cannot be ignored. Unless the cows are habitually grazed on grassland during the greater part of the year, when a lesser cubic space may suffice, a space of 800 c. ft. per cow is desirable.[1] Any height above 16 ft. should be neglected in the calculation. It should not be forgotten, however, that nothing in the way of cubic space will take the place of efficient ventilation, as a cow-house, however large, will become fetid unless the air is constantly changing.

LIGHTING AND VENTILATION.—If clean milk is to be produced, adequate lighting of the cow-house is essential, particularly in the rear of the cows. At least 3 sq. ft. of window space per cow is the minimum

[1] No standard of cubic space is specified in either the Milk and Dairies Order, 1926, or in the Scottish Model Dairy Bye-laws. Adequate floor-space is more important than cubic space. 50 sq. ft. per cow is a usual allowance.

requirement. Windows may be placed on the side or gable walls and in the roof. A central skylight, or high roof light, is essential in the double-range tail to tail type of cow-house. A cheap form of top-lighting may be obtained by the use of a number of glass slates, or tiles, in the roof. This may be found useful in the adaptation of existing buildings which are dark, but it does not assist ventilation.

As a rule it is desirable to provide side, in addition to top, lighting, and windows of the hopper type in the side walls are suitable for the purpose, as they provide a convenient means of inlet ventilation without the production of draught. A high window in the gable-end is useful both for light and ventilation.

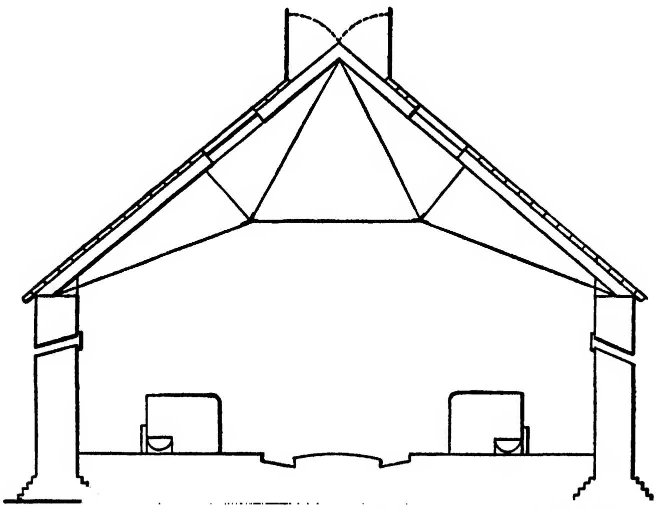


Fig. 4.—Section of Third Type of Cow-house fitted with Findlay Ventilator

Adequate ventilation is of great importance, and is essential for the health of the cows. In all schemes of ventilation provision must be made for the constant changing of the air by means of inlet and outlet ventilators for the admission of fresh and the exit of fetid air respectively. For this purpose openings in the walls will serve as inlets and in the roof as outlets. As already stated, hopper windows in the walls form good and easily controlled inlets, and in the larger cow-houses such windows, placed well above the level of the floor, may be the sole means of inlet ventilation.

In addition to windows, there may be openings in the walls situated at a height of 5 ft. 6 in. to 6 ft. from the floor level. It is recommended that such openings should be of an area of not less than 40 sq. in. per cow and they ought to be so arranged as to admit of the inlet of air being easily regulated to suit the conditions of the weather.

The best position for air outlets is the apex of the roof, and these may

be simply and economically attained by raising one in every two or three ridge tiles, superimposed and bedded upon adjoining ones, a process usually known to builders as "horsing" the ridge. By means of such small but numerous openings down draughts are lessened, but such a system of outlet ventilation is, of course, not under control, and cannot be regulated. Openable skylights or louvered ventilators are sometimes employed, but the latter are not free from the disadvantage of causing undesirable down draughts.

A good form of outlet ventilator is that introduced by Mr. John Findlay (fig. 4). The roof, instead of being carried up to the ridge in the usual manner, stops short about a foot from it on either side, thus leaving an elongated open space which traverses the centre of the roof from end to end. This space is occupied by long-shaped windows hinged at their lower borders. These windows, when closed, continue upwards the slope of the roof, meeting against one another at the point where the ridge would ordinarily be. When opened, they rise toward the perpendicular, leaving an open space along the centre of the roof. They can be opened to any required degree by a mechanical arrangement, and they serve the double purpose of lighting and ventilation.

Doors.—"The doors for entrance and exit of cows in small cow-houses should not be less than 3 ft. 6 in. wide and 6 ft. 9 in. high in the clear, and in ordinary circumstances should be hung on strap hinges in two halves, the lower of which should be about 4 ft. high. For such doors a plain, strong ledged and braced construction is the most suitable. Sharp angles of frames should be rounded off, and where doors are hung to brickwork the brick angles should be rounded. These doors should open outwards, flat against the wall, and hooks should be provided to hold them open."

"In the larger types of building, wider doors, hung folding, may be used. Sliding doors are very useful in many positions, but are apt to be more draughty than hinged doors, and are therefore not generally so suitable for unsheltered entrances to a cow-house. In those cases where manure is transported on a slung carrier, the doorway must be high enough to allow the track and carrier to pass at a convenient height. Double folding or sliding doors are practically essential in such cases, to permit the passage of the track."[1]

One or more wash-hand basins with cold water laid on are a great advantage in a cow-house. A supply of hot water is, unfortunately, seldom available.

DAIRY BUILDINGS

The Dairy.—It is convenient to house the milk room, washing-up and sterilizing room and boiler house under one roof but internally

[1] Ministry of Agriculture and Fisheries Bulletin, No. 40.

separate. The building should be close to the cow-house but entirely separate from it.

The Milk Room.—A suitable milk room is a matter of much importance in the production of clean milk. Unless bottling on the farm is practised it need not be large, 10 ft. by 8 ft. sufficing for a herd of 50 cows.

During the process of cooling, milk is freely exposed to the air and very liable to contamination. With the view of avoiding this it is necessary that:

(*a*) The milk room should be used for no other purpose except for the storage of sterilized milk utensils.

(*b*) The site of the building should be carefully selected so as to ensure freedom from dust, flies, and smells. Proximity to the dung heap, liquid manure tank, stack yard, and chaff cutting and mixing rooms must be avoided. In order to exclude flies the doors, windows and ventilators may, in summer, be screened with wire gauze frames.

(*c*) The milkers should not enter the milk room, but should pour the contents of their pails into an outside receiving tank communicating with the cooler by means of a pipe passing through the wall. The tank and pipe should both be removable for purposes of sterilization. The tank, which should be placed at a convenient height approached by one or two steps, may with advantage be protected by a small roof, and ought to be provided with a hinged easily lifted cover.

Ample light and ventilation are necessary in the milk room, and may be provided by windows or by roof lights. A flat ceiling is an advantage. The walls should be faced with cement, finished smooth, or other washable material, to a height of 4 ft. 6 in. Behind the cooler the wall should be cemented to the level of the roof or ceiling. The whole of the wall, ceiling, or roof, surface not habitually washed should be frequently limewashed. The floor must be of some smooth, impervious, easily washed material without crevices that harbour dust. Channels should be provided in the floor for the conveyance of all drainage and floor washings to an outside drain. There must be no internal drain or trap. In addition to the cooler, racks for sterilized utensils are desirable. An abundant supply of pure water for cooling and washing up is, of course, essential.

The Washing-up and Sterilizing Room should be of similar construction and finish to that of the milk room and must have good light, impervious floors and walls, outside drainage and a supply of clean water. It must not only be sufficiently large to accommodate the apparatus necessary for washing-up and the sterilizing tank but to afford adequate space for the convenient handling of the utensils. Hot and cold washing tanks must be provided, and galvanized iron tanks with suitable emptying

plugs are best. Wooden tanks should never be used. Drainage racks should be fixed at the side of the hot-water tank. An abundant supply of hot water and steam for sterilization are essential.

" Where only a few cows are kept, the boiler may be either an ordinary farm copper or a simple piece of apparatus on rather similar lines, and on this small scale the boiler may be housed in the same room as the cleansing apparatus. It is, however, much better in a separate room because of the dust from the fuel."

" In the case of low-pressure boilers hot water may be obtained by blowing steam through a nozzle into a tank of cold water."

" A sterilizing tank or chest into which live steam can be blown is also a necessary item. A tank 2 ft. 9 in. by 2 ft. 6 in. by 4 ft. 6 in. is big enough for a herd up to 40 cows. This also may be of stout galvanized iron, and should have a tight-fitting lid, which need not, however, be absolutely steam-tight. A strip of copper-asbestos packing round the closing edge gives sufficient tightness when secured with swinging bolts and butterfly nuts. It is a mistake to have too large a tank, since it may be difficult to raise sufficient steam to bring every part of it to 210° F., which is the required temperature. A drainage hole is necessary, also a metal grid above the bottom of the tank to keep utensils 3 in. up and allow for steam circulation and drainage. Even distribution of steam by perforations or bifurcation of the steam pipe, and a thermometer in a position remote from the steam inlet, are necessities."

" The sterilization of churns is often performed separately by means of a steam jet brought up through a block or pedestal about 6 in. above the floor, upon which churns are inverted singly. The steaming apparatus (steam chest, jet and block) should be in that part of the room nearest to the boiler."

" If an ordinary farm copper in the washing room is used to supply hot water, it may also be adapted as an effective steamer by boring a 2½ in. diameter hole in the centre of the lid and fitting therein a short length of pipe, projecting 3 in. upwards, over which utensils may be inverted as in the case of the steam-block. ¼-in. wooden strips should be fixed on the lid to keep the inverted utensils from contact so as to permit drainage and avoid contamination from previous use. To allow the cooler, strainer and small apparatus which cannot be steamed over this jet to be properly sterilized, a perforated steam chest, which can itself be so placed, is necessary. An ordinary sanitary dustbin or galvanized tank provided with a lid can be simply converted for this purpose."

" Other simple portable apparatus for steam-raising by means of gas or primus stoves is available for dairy uses. If used they must be placed in a position free from strong draughts."

"**The Boiler Room,** with space for a vertical steam boiler of from 1½ to 2 h.p. and for storage of fuel, may also serve usefully as a drying room for wood and for the outdoor clothes and boots of workers. The

boiler should be only sufficiently big to fulfil its purpose. Several good types specially designed for dairy use are on the market."[1]

PROCEDURE NECESSARY FOR THE PRODUCTION OF CLEAN MILK

Having discussed the hygiene of cow-houses and dairies, the procedure necessary for the production of clean milk is summarized below:

(*a*) **The Workers** should be healthy, clean in person and in clothing. Intelligence on their part is essential, and they must be prepared to give the requisite attention to detail until the necessary technique becomes a regular habit.

(*b*) **The Cows** must, of course, be healthy and they should always be kept clean and well groomed. The flanks and udder should be clipped by means of hand-clippers. The long silky hair on the udder is liable to harbour dirt and should be kept short.

(*c*) **Milking.**—Dust in the air of the cowshed at milking time is detrimental to the cleanliness of the milk and all practicable measures ought to be adopted to eliminate this source of contamination. Thus the feeding of cows is apt to give rise to dust and should, therefore, follow rather than precede milking. For similar reasons the bedding ought not to be disturbed during milking time.[2]

Preparation of the Cow.—Immediately before milking, the udder and teats of each cow should be washed with a *clean* cloth and clean water, and left moist so that any dirt remaining on the udder is less likely to fall into the pail. The udder should, however, not be left wet lest excessive moisture drip into the pail. An udder with a damp surface is what is desired.

Preparation of the Milker.—The hands should be thoroughly washed with soap and water and dried on a clean towel. The use of a nail-brush is desirable. Clean white overalls, made of some washable material, should then be put on. A milking cap is also desirable. The milkers should wash and dry their hands on a clean towel before milking each cow.

Method of Milking.—The first two squirts of milk from each teat should be rejected as thereby milk of greater bacterial cleanliness may be obtained. The milking stools should be scrubbed

[1] Ministry of Agriculture and Fisheries Bulletin, No. 40.

[2] The Milk and Dairies Order, 1926, requires that no dry bedding or other dusty matter shall be moved in the cowshed during the milking, or within half an hour before milking commences, except so far as may be necessary for the removal of dung.

after each milking as a clean hand will be contaminated by a dirty stool.

Milking should always be performed with dry hands. So called "wet milking" may give rise to serious contamination of the milk, and milkers should therefore never dip their hands in the milk or moisten them in any way as such a practice is most undesirable and quite unnecessary. It need hardly be added that the very disgusting habit of spitting upon the hands before commencing milking ought not to be tolerated.

Milking Pails.—With the view of preventing contamination from dirt falling into the milk, use of thc covered type of milking pail is strongly recommended. The essential feature of such a pail is that the opening shall be as small as admits of convenient use and nearly vertical, thus presenting as small a surface as possible for the entrance of dirt which may fall from above.

As soon as the milking of a cow is completed, the milk should be removed from the cow-house and strained.

Milking Machines.—By the use of such mechanical means of milking, the milk is drawn into a more or less completely sealed pail, but the lengths of rubber tubing, teat cups, and receiving pails have to be cleansed and sterilized twice daily. which takes time and is not very easily accomplished.[1] Further, the teat cups occasionally fall off the teat and may suck into the machine dust or debris from the floor. Where a milking machine is used, the "fore-milk" should be rejected before applying the teat cups, and the cows have to be "stripped" by hand. As regards the bacterial content of milk, it is stated that in practice properly conducted hand-milking gives more uniform results than those generally attained by the use of a machine.

Straining of Milk.—Notwithstanding the adoption of all necessary precautions in connexion with milking, a small quantity of dirt will occasionally gain access to the milk and should, so far as possible, be removed by straining (see p. 353). A strainer consists of a conical metal funnel, ending in a short cylinder, just above which is a ledge supporting two gauze metal discs, which act as strainers. Between the strainers is placed the filtering material, which may be in the form of cotton-wool discs, or straining cloths are

[1] As the rubber commonly used in milking machines was formerly such as would be injuriously affected by steam, chemical agents, such as hypochlorites, were sometimes employed for sterilizing those parts. Improvement has, however, taken place in the design and construction of such machines and steam sterilization is now not only practicable but more effective than sterilization with chemical agents.

sometimes employed. The cotton-wool discs are discarded after use, but the cloth may be used on several occasions. It should be rinsed in cold water as soon as the filtering process is completed, then washed in hot soda water and rinsed in clean hot water before being boiled. After boiling, the cloth should be mounted in the strainer and steamed with the other utensils.

Cooling of Milk.—As soon as the milk has been strained it should be cooled.[1] This is generally effected by passing it over a cooler, which consists essentially of a coil of pipes, over the surface of which the milk flows in a thin film-like stream from above downwards, while cold water traverses the interior of the pipes from below upwards. Thus the milk trickles over the lower part of the cooler last and leaves the instrument at the lowest temperature obtainable. With the view of protecting the milk from contamination during the cooling process detachable metal covers are often supplied with coolers and may be an advantage. As already stated, cooling has a marked effect in inhibiting the growth of micro-organisms.

> "The rate of growth of the common milk bacteria is profoundly influenced by the temperature and is greatest at temperatures over 60° F. Every effort must, therefore, be made to cool and retain milk as much below this temperature as possible. Unfortunately, some dairy farmers, through the lack of a good water supply, are not in a position to cool milk as it should be cooled, but it is equally certain that the best use is not always made of the supplies which are available. The necessity for keeping milk cool until delivery at the station is also not sufficiently appreciated." [2]

Milk Churns.—Ten-gallon churns are preferable in every way to the old seventeen-gallon pattern. The interior of the churn should be free from seams, and those made in one piece without seams are the best. The lid of the churn should be designed to prevent splashing and shoot off rain, and there should be no holes in the lid for purposes of ventilation which is undesirable and unnecessary.

Bottling of Milk.—The best method of distributing milk is in glass bottles, and bottling direct from the cooler is very desirable. A special bottling apparatus is seldom necessary on a farm. After filling, the bottles require to be disced and capped. A well-waxed stout disc and an impregnated paper cap which will resist wetting should be used. Good combined discs and caps are now on the

[1] The Milk and Dairies Order, 1926, subject to certain specified exceptions, requires milk, without any delay other than that caused by straining or centrifugalization, to be cooled to a temperature not more than 5° higher than the temperature of the water supply available for cooling.

[2] *The Production and Distribution of Clean Milk*, by A. T. R. Mattick. B.Sc.

market. These are " cramped " on to the neck of the bottle by hand or power machines, and form an effective seal.

Paper Containers.—Containers of papier mâché, or similar material, are sometimes used. A machine has been built which makes the container, sterilizes it with wax, cools and fills it with milk, and finally, seals it in one continuous operation. By use of a paper carton delivery, the difficulty and cost of collecting empty bottles would disappear, breakages would be checked, weight would be lessened per given quantity of milk carried, washing would not be necessary, as no container could be used twice. It is also claimed that hygienically the paper container ensures good keeping properties in the milk and freedom from contamination. The objection is sometimes raised that the purchaser cannot *see* the milk. In order to ensure that they are sterile, cartons should be waxed immediately before use.

Care of Dairy Utensils, &c.—These, together with the cooler, should be: (*a*) rinsed with cold water immediately after use; (*b*) thoroughly washed and scrubbed with hot water to which soda has been added; (*c*) rinsed in clean water once more; and (*d*) sterilized.

Scalding will not take the place of sterilization. The utensils must be heated by steam to a sufficiently high temperature for a sufficient time to destroy all bacteria. Sterilized utensils must be protected from contamination until required for use.

Udder cloths and everything else that may come in contact with the milk must be washed and sterilized after each milking.

Washing and Sterilization of Milk Bottles.—Bottles are sometimes difficult to clean on account of the presence of old dried milk, and the use of bottle brushes, whether hand or power driven, may be inadequate for the purpose. In such circumstances the bottles may be immersed for some hours in a tank containing a solution of soda. On removal the bottles must be thoroughly washed in cold water either by hand or by a power driven brush. Bottles should always be sterilized by steam, being packed in wire baskets before being placed in the sterilizer.

MILK-BORNE DISEASES

Tuberculosis

Of all milk-borne diseases, tuberculosis is the most important. The position is admirably summarized at the end of the Ministry

of Health Memorandum on Bovine Tuberculosis in Man, with Special Reference to Infection of Milk (Public Health and Medical Subjects, No. 63).

Summary as to Present Position

1. "The death rates for non-pulmonary forms of tuberculosis in England and Wales, while still high, are decreasing, the rate for 1929 being less than half that for 1911. Loss of life and invalidity from this disease are, however, still matters for grave concern.

2. "It is not possible at present to say what proportion of the cases of tuberculosis in human subjects are of bovine origin, but it seems probable that more than 1000 children under 15 years die annually in England and Wales from infection of this origin.

3. "It is practically certain that the great majority of human infections with the bovine tubercle bacillus are conveyed by means of cow's milk, and that infection usually occurs during the early years of life, when milk forms a large part of the diet and when susceptibility to infection is greatest.

4. "The proportion of milch cows in this country infected with tuberculosis is not accurately known, but there is reason to believe that it is not less than 40 per cent. Cows are much more often affected than other bovines, and those suffering from tuberculous mastitis[1] are responsible for most of the infection in human beings. The proportion of cows so affected has been variously estimated at 0·3 per cent to 6 per cent. These estimates, however, apply to cases of "open" tuberculosis and there are in addition many cows showing no clinical signs of tuberculosis but excreting the bacilli in their milk and fæces. The proportion of cows actually yielding tuberculous milk is probably between 1 per cent and 2 per cent. Whether the incidence of tuberculosis in bovines is increasing or decreasing is not known.

5. "Complete eradication by means of universal tuberculin testing and the slaughter of all reacting animals is not practicable in this country, not only on account of the expense and the dislocation of the milk supply which would be involved in any attempt at such a measure, but also because it is doubtful whether complete and permanent eradication could be effected by this means. A less drastic procedure, but one also involving the slaughter of infected animals, is represented by the Ministry of Agriculture and

[1] Tuberculosis of the udder.

Fisheries Tuberculosis Order of 1925. (See p. 502.) This Order aims at the destruction of cattle in an advanced and more infectious stage of the disease and cannot be expected, without the introduction of adjuvant measures, seriously to affect the incidence of the disease in cattle or man.

6. " The method of building up tuberculosis-free herds has been discussed, and the financial and other difficulties in the way of its success have been pointed out, but it is to be hoped that a more extensive trial will be given to it in this country.

7. " Calmette and Guerin claim to be able to prevent tuberculosis in young calves and babies by protecting them with their vaccine, known as BCG. This claim has not yet been established for babies, but there is evidence that a certain degree of immunity may be produced in young calves.

8. " The next method of control considered is one which has only been tried to a small extent in England and Wales, but has given such encouraging results in Scotland that its area of operation is being rapidly extended. This method is the routine clinical examination of cattle, which, to be fully effective, should involve the thorough and systematic examination by competent veterinary surgeons of all the milk herds at stated intervals, say twice a year, and the exclusion of those found diseased. There is reason to believe that such a procedure, when employed in combination with other methods of prevention, is productive of beneficial results.

9. " The testing of milk by the microscopic and biological methods can be of great value, especially when applied to samples from herds of moderate size (a complete list of the contributing cows being made at the time of sampling) and combined with competent clinical examination of the cattle.

10. " All measures aimed at the reduction of bovine tuberculosis must lose a great part of their effect so long as milch cows are kept under conditions which favour the spread of tuberculous infection. The education of the cowkeeper in the prevention of bovine infection should therefore occupy a prominent place in any scheme for the eradication of bovine tuberculosis.

11. " Reference has been made to the limited success so far achieved by the scheme for grading milk established by the Milk and Dairies (Amendment) Act, 1922, and the Milk (Special Designations) Order, 1923, made under that Act. The campaign in favour of clean raw milk must, however, be regarded as of great potential value, and the official grading of milk would constitute an impor-

tant element in any comprehensive scheme for the improvement of the milk supply.

12. "The Manchester Clauses and the provisions of the Milk and Dairies (Consolidation) Act, 1915, which superseded them, appear to have had but little effect upon the incidence of bovine tuberculosis or the sale of tuberculous milk, though the educational value of these measures has probably been far from negligible. The factors limiting their utility have been pointed out, and a consideration of these demonstrates the paramount importance of those measures which are applicable to the source of the infection or its near neighbourhood.

13. "This conclusion does not justify the neglect of safeguards for the milk consumer, which can be applied to the milk after production and before delivery. The problems and procedures of pasteurization have been reviewed, and it has been shown that, subject to careful operation and scientific control, this process ensures a milk which not only is safe for consumption, but also retains its food value practically unimpaired by the heat to which it is subjected."

Measures adopted to limit the Sale of Tuberculous Milk

The Milk and Dairies (Consolidation) Act, 1915, prohibits the sale of milk from a cow known to be giving tuberculous milk or to be suffering from emaciation due to tuberculosis or from tuberculosis of the udder. (The Milk and Dairies (Amendment) Act, 1922, also prohibits the sale of milk from a cow suffering from tuberculosis of the udder.)

The 1915 Act further provides for the sampling of milk, for bacteriological examination and for the stoppage of any milk supply likely to cause tuberculosis. If the tubercle bacillus is found in a sample of milk in any district, the Medical Officer of Health of the County or County Borough where the milk was produced must be notified, and he must arrange for the veterinary examination of the cows at the suspected farm and for any other necessary inquiries with the view of detecting the affected animal. When the tuberculous cow is discovered an order may be made prohibiting the use of her milk for human consumption. This course is, however, seldom followed, it being generally considered preferable to secure the slaughter of the cow under the provisions of the Tuberculosis Order, 1925.

The Tuberculosis Order, 1925, provides for the notification and slaughter of any cow suffering from tuberculosis of the udder and of any bovine animal suffering from either tuberculous emaciation or from a chronic cough accompanied by definite clinical signs of tuberculosis. Compensation is payable within prescribed limits for animals slaughtered under the Order.

The provisions of the Acts and Orders to which allusion is made above have for their object the suppression of the sale of tuberculous milk, but the work involved is attended by many practical difficulties and it is to be feared that the results attained leave much to be desired.

Having regard to the extent to which milk is mixed before delivery to the consumer, one cow giving tuberculous milk may infect a considerable quantity of other milk. It is true that the tubercle bacillus in the mixed milk will be present in less concentration, but the milk might not be rendered innocuous on that account, and the number of persons exposed to infection will be largely increased. It is probable that, excluding samples taken from suspected sources, an average of between 6 and 7 per cent of the samples taken throughout the country contain living tubercle bacilli.

Owing to the increasing practice of " bulking " milk, it often happens that an infected sample is taken from the mixed milk derived from a large number of farms, and it may prove impossible to identify the farm, far less the cow or cows from which the tuberculous milk was derived. Systematic sampling of milk from individual farms before " bulking " takes place would therefore appear to be a necessary safeguard. This might conveniently be carried out at the collecting depot.

As reliance cannot be placed upon direct microscopical examination for the detection of the tubercle bacillus in samples of bulked milk, biological examination (by means of guinea-pig inoculation) is usually necessary. Unfortunately a period of from four to six weeks must elapse between the taking of a sample and the report of the result of the biological test. In the meantime tuberculous milk will in all probability continue to be consumed, or, if the affected animal has been disposed of, its subsequent detection will be rendered difficult or impossible.

Routine Clinical Examination of Cattle.—There appears at present to be some difference of opinion respecting the value of this procedure as a means of checking the distribution of tuberculous milk. While it is not possible to detect all cases of tuberculosis of

the udder, those who advocate this method claim that if the examinations are thoroughly conducted by a competent veterinary surgeon the majority of cows secreting tuberculous milk can be detected. Dr. Moore[1] states that, while the physical examination will not detect more than from 1 to 5 per cent of infected animals which may be in a herd at any one time, yet he believes it will detect from 80 to 85 per cent of those animals which are actually spreading the germs of tuberculosis. By frequent examinations, and the removal of those animals which are doing the actual harm, it is claimed that much may be accomplished in eradicating tuberculosis from dairy herds.

In assessing the results attained by a procedure of this sort, due regard must be had to the manner in which it is conducted. In some instances the examination is limited to herds in which an animal in the advanced state of the disease has been discovered, while in others every herd in the area is systematically examined at stated intervals. Any such method of control is, however, handicapped by the constant buying and selling of cows by means of which fresh sources of infection may be introduced into herds by animals from outside sources.

It must also be realized that between 1 and 2 per cent of reactors which show no clinical signs of tuberculosis excrete tubercle bacilli in their milk. Therefore, no control which does not include tuberculin testing can be relied upon to secure a safe milk supply and even this strict control cannot secure absolute safety.

Lack of Uniformity in Administration.—Although the Milk and Dairies Order, 1926, imposes the duty on County and County Borough Councils to " cause such inspection of cattle to be made as may be necessary and proper for the purposes of the Act and Order ", the Authorities concerned have taken very different views of what is necessary and proper. In many English Counties there is no routine inspection at all, and farms are only visited by veterinary inspectors where there exists a suspicion that milk-borne tuberculosis is traceable to them. In other cases, the Authority has instituted regular clinical inspection at varying intervals by whole-time or part-time inspectors. In a few of these cases, the routine inspection is carried out as often as four times a year.

In this connexion it may be stated that routine clinical inspection at least once a year is compulsory in Scotland under the Milk and Dairies (Scotland) Act, 1914, and that the Department of Health

[1] *16th Annual Report*, U.S. Live Stock Sanitary Association.

for Scotland recommends that such inspections should be carried out three times a year.

Tuberculosis-free Herds.—Bang's method of eradicating tuberculosis from dairy herds has given good results in Denmark. All cows suffering from tuberculosis of the udder, or with signs of wasting disease, are slaughtered. The herds are tested with tuberculin and those giving a positive reaction are separated from the healthy animals either by keeping the two classes of animals on separate farms or in sheds as far removed from one another as practicable. Healthy calves are reared from the healthy stock, and great care is exercised to prevent the introduction of fresh infection. Calves born of tuberculous cows (with the exception of those in an advanced stage of the disease) are rarely born infected and generally grow into healthy animals if they are removed at birth to clean premises and fed on milk rendered innocuous by being heated to 80° C. By means of constant vigilance, disinfection of sheds, &c., and half-yearly, or more frequent, tuberculin tests, every effort is made to prevent the healthy herds from becoming reinfected. These methods are employed in connexion with the herds from which Certified and Grade A (tuberculin tested) milk is derived.

OTHER MILK-BORNE DISEASES

As already stated, milk is an ideal medium for the conveyance of infection because it serves as a culture, not only for numerous saprophytic but also for a number of pathogenic (disease producing) organisms. Thus milk may be the vehicle by means of which are spread not only the intestinal bacteria that give rise to the typhoid and paratyphoid fevers, cholera, dysentery, epidemic diarrhœa, and food poisoning, but also those of diseases in which an inflammatory condition of the throat is a prominent feature, such as diphtheria, scarlet fever, and septic sore throat. From the time when it is drawn from the cow until it is consumed, milk is liable to contamination by the causative organisms of disease from the hands or clothing of the milkers or others handling or delivering the milk, from the milk utensils, or the water in which they are washed, or through the agency of flies. Tuberculosis, undulant fever, foot-and-mouth disease, and septic sore throat may be conveyed in the milk of diseased animals, while it appears probable that the cow may occasionally be the source from which diphtheria and possibly scarlet fever infection is derived.

Milk-borne outbreaks of infectious disease are generally characterized by their sudden onset, a large number of persons being simultaneously attacked, or nearly so, while two or more persons in the same household are frequently taken ill at the same time. The outbreak rises rapidly to its height and declines more slowly, being usually prolonged by the occurrence of secondary cases. More children are affected than adults, and more females than males.

Typhoid Fever[1] **and Paratyphoid Fever** have not infrequently been spread through the agency of specifically infected milk or cream. The primary source of typhoid bacilli is, of course, the typhoid fever patient. The fæces of such a patient contain large numbers of the bacilli, the urine also being not infrequently infected. Infection of milk may result from persons milking or handling the milk utensils, or coming in contact with the milk, while in an infectious condition, such as "carriers"[2] or persons who are suffering, or who have suffered from, a mild and unrecognized form of the disease; or persons who have nursed or in some way come in contact with a patient suffering from the disease, or who have handled the discharges or the soiled clothing or bedding of a typhoid patient. Infection may be caused by the use of contaminated water, either for washing the milk utensils or for the fraudulent dilution of the milk. It has also resulted from washing the clothing, or bed linen, of sick persons along with the milk utensils, &c. The typhoid bacillus multiplies rapidly in milk without in any way altering its appearance or taste.

Dysentery is occasionally spread by milk. An extensive milk-borne outbreak with 978 cases and 72 deaths occurred in Aberdeen in 1919 and was reported by Dr. Kinloch. The milk was derived from a farm at which several persons, including a milkmaid, had suffered from diarrhœa. The farmer's sister, who had been nursing dysentery in Salonika, was probably the source of infection. The organism was of the Flexner type.

Cholera is not very often milk-borne, but one or two such outbreaks have been reported.

Epidemic Diarrhœa may be conveyed by milk which, owing to improper handling or storage, has been contaminated by flies, dust, &c.

[1] Sometimes called Enteric Fever.

[2] "Carriers" are apparently healthy persons who harbour the specific organism and may be a source of infection to others. The carrier condition is known to exist in the throat in diphtheria, cerebro-spinal meningitis, and possibly scarlet fever, and in typhoid, paratyphoid, dysentery and cholera in the intestine and sometimos in the urinary secretion.

Scarlet Fever.—Many outbreaks of milk-borne scarlet fever are on record. In most instances persons employed in milking or handling milk vessels or delivering milk while suffering from, or convalescent after, scarlet fever, have been the source of infection.

It was at one time thought that cows suffering from ulcers on the teats and udders due to streptococcal infection (Hendon Disease) might give rise to scarlet fever in the human subject. The available evidence on the point is not conclusive, but it appears probable that, in the event of ulceration of the teats occurring as a result of cow-pox or other cause, the organisms of scarlet fever might possibly be implanted on the sores as secondary invaders of the cow-pox lesion, thereby contaminating the milk.

Diphtheria.—Milk-borne outbreaks of this disease have generally been attributed to a human source. Thus instances are on record in which the disease existed at the farm or dairy supplying the milk, or the milkers, or persons delivering milk have suffered from clinical diphtheria or sore throat or have been found to be carriers of diphtheria bacilli.

The infection appears occasionally to have been derived from cows with sores on their teats, and, as in the case of scarlet fever, it is probable that such sores become secondarily infected with diphtheria bacilli.

Epidemic or Septic Sore Throat is caused by a hæmolytic streptococcus and is generally milk-borne. The source of infection has been ascribed to cows suffering from mastitis or with ulcers or an eruption on their teats. Although not all mastitis is fraught with danger to human life, a certain percentage of cases of mastitis are due to infection with hæmolytic streptococci dangerous to man. Sometimes one or more quarters of the cow's udder has been found to be infected without much outward sign of mastitis. In one or two instances the milkers were found to be suffering from tonsillitis, or sore throats, and may, perhaps, have been the means of infecting the cows or the milk. A severe outbreak of this disease occurred in Brighton. No fewer than 1000 families were affected, and sixty-five of the cases had a fatal termination.

Undulant Fever.—The *Brucella abortus* [1] is the cause of "contagious abortion" in cattle, and of "undulant fever" in man. The disease is widespread among dairy stock in this country, and, as a result, the specific organism is not infrequently found in milk.

[1] *Brucella abortus* has been found in 28 per cent of samples of raw milk in Aberdeen, and in 19 per cent of samples of raw milk in Edinburgh.

The disease may be conveyed to man by infected milk. Though relatively few human cases had until recently been reported in this country, the number detected appears to be on the increase.

Brucella militensis is the cause of Malta fever, which is prevalent in the island of Malta, the milk of goats being the vehicle of infection. After the consumption of goats' milk had been prohibited, the disease disappeared from the British forces stationed in the island.

Foot-and-Mouth Disease.—This disease has occasionally been communicated to children by the consumption of milk from cows affected by the malady, particularly when vesicles were present on the udder. In children the disease manifests itself by a vesicular eruption on the mucous membranes of the lips, mouth, and throat.

Food Poisoning.—Savage and Bruce White have called attention to a number of outbreaks of food poisoning ascribed to consumption of infected milk, members of the Gaertner or Salmonella group of bacteria having been isolated in some instances.

PASTEURIZATION

" Pasteurization of milk began to be adopted by the distributive trade towards the end of last century, solely for the purpose of adding to its keeping properties, and thus enabling it to be delivered to the consumer in a marketable condition. In other words, the poor quality of the milk produced at the farm, and the long distances between the various sources of supply and the large towns, forced pasteurization on the distributors. By preventing wastage, pasteurization indirectly proved a boon to the farmer. At the present day, even with an improved milk supply, the long distances travelled, and the time taken, render some form of heat treatment necessary in large centres of population to prevent deterioration before delivery to the consumer.

" ' Flash pasteurization ' was the method first practised. So variable was the temperature employed, so difficult the control, so uncertain the results bacteriologically, and so marked the changes in the milk from the commercial aspect when the higher temperatures were used, that it gave way to the ' positive holder ' method, which received official recognition and became legally defined under the Milk (Special Designations) Order in 1923. If milk is now sold as pasteurized it must have been heated to a temperature of 145°

to 150° F. and held at that temperature for thirty minutes, and subsequently cooled to 55° F. It would prevent much confusion and difficulty in discussing scientific observations if the term pasteurization were reserved solely for this specified form of heat treatment of milk." [1]

In the following notes the term pasteurization is used in this sense and in this sense alone. It should be understood that " flash pasteurization " is still sometimes employed by milk traders with the view of postponing the souring of milk, but it has been universally condemned by hygienists as being unsatisfactory and will receive no further notice in these pages.

The object of pasteurization is to destroy any pathogenic bacteria which may be present and to reduce the number of other organisms (more particularly the lactic acid organisms which produce souring of milk) without appreciably altering the physical and chemical characters of the milk. With this end in view the milk is heated to a sufficiently high temperature, and maintained at that temperature for a sufficient length of time to have the desired effect upon the bacterial content, but not to so high a temperature as would alter its character in the above sense. One of the practical difficulties in connexion with pasteurization is that the limits of temperature within which these objects may be attained are very narrow, and it is essential, therefore, that the process should be carefully regulated and controlled.

Exposure to a temperature of 145° to 150° F. for 30 minutes will destroy the causative organisms of all the diseases usually spread by milk, including the *B. abortus* and the virus of foot-and-mouth disease. Certain strains of streptococci may survive pasteurization, but those which give rise to scarlet fever and to septic sore throat are destroyed.

As regards the tubercle bacillus, while pasteurization is usually effective in destroying this organism, it does not afford an absolute guarantee that milk so treated will contain no living tubercle bacilli. Reference is made in the Ministry of Agriculture and Fisheries Bulletin, No. 31, to the valuable investigations made by L. J. Meanwell into the thermal death point of tubercle bacilli in naturally infected milk. In addition, Meanwell made an epitome of his own work and that of others from which the following conclusions are drawn:

[1] " Is Pasteurization the Solution of the Milk Problem?", by Thomas Orr, M.D., D.Sc., &c., *Public Health*, August, 1932.

"First, that Meanwell himself carried out 39 experiments in which naturally infected and apparently normal tuberculous milk was heated to 145° F. for 30 minutes, and found living tubercle bacilli present on one occasion. In a second series of 19 experiments he heated naturally infected tuberculous milk which did not appear to be normal to the same temperature for the same time and again found living tubercle bacilli on one occasion. Secondly, that an epitome of recent work upon this subject demonstrated that of the four workers who employed naturally infected milk for their experiments, three found living tubercle bacilli after heating the milk to 145° F. for 30 minutes. Thirdly, that negative results were obtained by those workers who employed cultures of tubercle bacilli or pathological material which required chemical treatment before it could be inoculated. Fourthly, Meanwell's work demonstrated that tubercle bacilli in naturally infected milk which had been heated to 140° F. for 20 minutes were usually destroyed, but that this combination of time and temperature left no margin of safety.

"Meanwell finally concluded that commercial pasteurization of milk at 145° F. for 30 minutes, when efficiently carried out, is usually effective in destroying the tubercle bacillus, but that milk subjected to this process cannot always be guaranteed to be entirely free from this organism, especially when one takes into account the fluctuations in temperature, possible mechanical defects in the plant, and the natural desire to hold the milk at as low a temperature as possible in order to conserve the cream line. These factors are all liable to be present when working under ordinary conditions.

"Though pasteurization destroys a large proportion of the non-pathogenic organisms, it does not destroy them all. The great reduction in the number of lactic acid organisms which takes place retards the souring of the milk, but, as a few of these organisms survive, properly pasteurized milk, on being kept, will become sour, like ordinary milk, before putrefaction occurs.

"In regard to dirty milk or milk which contains a large number of bacteria, pasteurization will effect a reduction in the bacteria present, but the number remaining will be greater than in the case of milk which was clean and contained relatively few bacteria before pasteurization. In other words, the keeping qualities of clean milk which has been pasteurized are superior to those of dirty milk after pasteurization. Such a consideration provides a commercial incentive to produce milk of reasonable cleanliness for pasteurization. An additional

check which can be imposed is the requirement of a bacterial count after pasteurization with which only a milk which was sufficiently clean before pasteurization could comply."[1]

When pasteurization is properly carried out, the taste of the milk is little altered, and, as any alteration in this direction may depend, to some extent, upon exposure of the milk to air during the process of pasteurization, this should be avoided so far as practicable. According to Hamill the " cream line " (the line of demarcation between the milk and the cream which appears when milk is allowed to stand and the cream has risen to the top) is hardly, if at all, affected by pasteurization at 145° F. for 30 minutes, but is affected above that temperature.

" When milk is pasteurized at 145° F. for 30 minutes no appreciable change takes place in the milk proteins; if, however, the temperature is raised to 150° F. for 30 minutes a small proportion (about 5 per cent) of the milk albumin is rendered insoluble. Coagulation by rennin occurs slightly more rapidly in pasteurized than in raw milk. The soluble calcium and magnesium phosphates of the milk do not become insoluble or separate out when milk is pasteurized at a temperature of 145° F. for 30 minutes. This treatment has, furthermore, only a slight effect upon the enzymes which are present in milk."[1]

As already stated, milk contains vitamins A, B, C, and D. Vitamins A and B have a relatively high resistance to heat and pasteurization has probably no effect upon them. Vitamin C is partly destroyed by pasteurization, and although milk is, at best, a poor source of supply of this vitamin, its partial destruction is a matter of importance as it weakens the antiscorbutic property of the milk. The effect of heat on vitamin D (the antirachitic vitamin) is not known with certainty, but, having regard to the fact that fresh cows' milk has an antirachitic potency of only 1/500 of that possessed by cod-liver oil, reliance cannot be placed upon it for the satisfactory development of the bones and teeth of the growing child. The deficiencies in vitamin content of pasteurized milk may be rectified by the addition to the diet of orange or lemon juice (to supply vitamin C) and cod-liver oil (vitamin D).

The destruction of vitamins appears to be due to oxidation and is accelerated in the presence of air. Any precautions, therefore, which may be taken in pasteurization to exclude air with the object

[1] " Notes on the Pasteurization of Milk ", by J. M. Hamill, O.B.E., M.D., D.Sc., *Ministry of Health Reports on Public Health and Medical Subjects*, No. 17.

of preventing changes in taste and flavour would also act beneficially in safeguarding the vitamins.

Effect of Pasteurization on Nutritional Value of Milk.

The controversy that has always attended discussion of this question was brought into prominence by the proposals of the Manchester and Glasgow Town Councils to promote legislation for the compulsory pasteurization of all milk used for liquid consumption other than that produced from licensed tuberculin-tested herds. All the relevant published evidence on the subject is reviewed by Stirling and Blackwood in the Hannah Dairy Research Institute Bulletin, No. 5, 1933. The authors consider the question in relation to two periods of life, namely: (*a*) infancy, when milk represents almost the only source of those elements required for energy and structural purposes, and (*b*) later childhood, when development needs are still very important, but when milk does not represent the whole source of food materials. The authors conclude:

"There are strong grounds for the belief that infants can satisfy all their requirements on diets of adequate amounts of pasteurized milk, provided that extra vitamin D, and of course vitamin C, are added to the diet.

"There do not appear to be any good grounds for the belief that pasteurized milk is a less valuable component of the diet than raw milk for children who satisfy the bulk of their nutritive requirements from sources other than milk."

Reference has already been made to the results of the valuable experiment conducted by Dr. Corry Mann (p. 349).

"In Greater London, since 1920, pasteurization of milk has been rapidly increasing until at the present time, so far as I have been able to calculate, based upon figures pertaining to my own area (and there is no reason to believe that the rest of Greater London is different), 92 per cent is so treated, 76 per cent being pasteurized by an approved holder plant. Greater London has a population of about one-fifth of the whole of England and Wales, so that a valuable test of any loss of nutritive value in pasteurized milk has been going on with a very large population for several years. No doubt the test has been uncontrolled, but if any tangible adverse effects occurred they would surely have been discovered and dilated upon." [1]

While, in the present state of our knowledge, it may perhaps be

[1] "Is Pasteurization the Solution of the Milk Problem?", by Thomas Orr, M.D., D.Sc., &c., *Public Health*, August, 1932.

unwise to dogmatize on the question of the relative nutritive value of raw and pasteurized milk, it appears that any slight diminution in nutritive value, which may occur as a result of pasteurization, can easily be remedied by the addition to the diet of orange or lemon juice and cod-liver oil. But that is only one of the factors which should be considered. It is of much greater importance to weigh the significance of any trivial loss of nutritive value which may result from pasteurization against the danger of raw milk as a vehicle for the spread of tuberculosis and other infectious diseases. When the matter is considered from that standpoint, the evidence in favour of pasteurization is overwhelming.

"Holder" Pasteurizers

There are many different forms of "holder" pasteurizers, of which one or two typical examples may be given:

BATCH PASTEURIZATION.—"This process, which originally consisted in heating, holding, and cooling a batch of milk in a single vessel, is used, in a slightly modified form, in a considerable number of good and thoroughly modern small dairies, but only for the treatment of from 50 to 300 gallons per day." "For the small capacities named the 'batch' method offers definite advantages, and, if conscientiously operated, is capable of yielding a first-class product." (Seligman.[1])

In its simplest form, the "batch" pasteurizer consists of a covered jacketed vat, or tank, in which the milk is heated to, and held at, the required temperature for 30 minutes. Heating is effected by the introduction of hot water, or steam, to the jacket which surrounds the tank, and, in order to secure that the milk is evenly heated, a mechanically operated milk-agitator is employed. A mercury thermometer is often fitted, but a recording thermometer is preferable, if not essential, for efficient work.

"As a rule, the process has been modernized to the extent that the final stage of cooling, at least, is performed in a special unit, the slow cooling which is inseparable from treatment in the holding vessel being unfavourable to low bacterial counts, good flavour, and a good cream line. In the operation of a "batch" plant it is desirable that pumps, pipe lines, &c., which have been used for the raw milk be not used again for the finished product. Only where

[1] "Pasteurization Methods", by Richard Seligman, Ph.nat.D., F.Inst.Met., &c., Vol. LIII, No. 1 (1932) of the *Journal of the Royal Sanitary Institute*.

perfect reliance can be placed on the thoroughness of the operator, can it be assumed that such auxiliary apparatus has been thoroughly sterilized between the operations of filling and emptying the holding vessel. It is essential to ensure that no milk can be " held " outside the heated jacket of the holding vessel—a condition with which it is not very easy to comply." (Seligman.)

Pasteurizers in which the Milk is heated before passing to the Holder Tanks.

Heaters and Coolers

In the " batch " system heating and cooling of the milk may be effected in the holding vessel, though a separate cooler is generally employed. In the continuous positive holding system of pasteurization, however, the heating and cooling apparatus are entirely distinct from the holders. Sometimes heating and cooling are effected in separate machines, but the use of combined heaters and coolers is now all but universal. The process known as " direct regeneration " may be carried out in these combined machines, that is to say, the milk to be pasteurized is partially heated by milk which has already been heated, the latter being itself partially cooled in the process.

Three types of combined machines are in use in this country, but the last-mentioned is most frequently employed.

(*a*) The first resembles an open cooler, over the outside of which flows the milk to be cooled, while the milk to be heated is pumped through the tubes. It is difficult to maintain the interior of the tubes in a cleanly condition, and the milk flowing over the surface is liable to contamination from the air.

(*b*) The second, called double-tube heat exchanger, comprises sets of concentric tubes suitably interconnected: " Through one set of pipes flows the milk to be heated; through the set within or without the former flows the milk to be cooled. These machines are capable of giving good results and are free from the objection of exposure of the pasteurized milk. They require, however, a great deal of space, not only to accommodate the long pipes of which they are formed, but at least an equal length for the withdrawal of the inner tubes. Cleansing and, above all, inspection are not easily accomplished, while the joints are difficult to maintain." (Seligman.)

" Both these types of heater-coolers require additional sections at one end for the final heating of the milk, which is usually effected

by hot water, at the other for cooling, which is usually done by brine, but occasionally by the direct expansion of ammonia or by ice water." (Seligman.)

(*c*) The third type is known as the plate heat exchanger or plate pasteurizer. In these machines the liquid to be heated or cooled flows on one side of a plate and the heating or cooling medium on the other.

The "A.P.V." Heat Exchanger, or Plate Pasteurizer,[1] is an ingenious device by means of which milk may be either heated or cooled without coming in contact with the air (fig. 5). The machine consists essentially of a number of heavily tinned gun-metal plates grooved upon both sides. Between each pair of grooved plates is placed a flat copper plate, which, when the plates are secured firmly in position, converts the grooves into pipes. The milk to be heated (or cooled) flows up and down across one side of the plate and the heating (or cooling) water up and down the other side of the plate but in the opposite direction. The two liquids exchange heat through the metal plates, and, as the grooves are long and shallow, the exchange is rapid. When in use, the plates are mounted on a frame and some may be devoted to one purpose and some to another. Thus heating and cooling can be effected with equal efficiency, while, if raw milk is circulated on one side of the plates and hot milk (returning from the "holders") on the other, the two flowing in opposite directions, the raw milk is heated and the pasteurized milk cooled.

"As a rule such machines are built up of four sections or sets of plates. In the centre is the regenerative section in which the raw milk is heated by milk already pasteurized. This is followed by a heating section, in which the milk is heated to pasteurizing temperature. As heating medium hot water is universally used in this country, and is always to be preferred. On the Continent it is sometimes replaced by steam. From the heating section the milk flows to the holding vessels and from these returns to the regenerator to give up part of its heat to the raw milk. Partially cooled, it now passes on to the water cooling and brine cooling sections, which complete its cooling to about 40° F." (Seligman.)

Among the advantages claimed for this machine are:

(*a*) The heating (when not effected by hot milk) is done by water only a few degrees hotter than the milk itself, and the milk does not come into contact with steam heated surfaces.

[1] Manufactured by the Aluminium Plant & Vessel Co., Ltd.

(*b*) The milk is not exposed to the air, thereby avoiding air-borne contamination and reducing to a minimum the effect of pasteurization upon the vitamins of the milk.

(*c*) The formation of foam is prevented. This is important as study of pasteurization has shown that the temperature of the foam is less than that of the milk while its bacterial content is higher.

(*d*) The whole machine may be rapidly dismantled after use, when thorough cleaning and sterilization are readily effected.

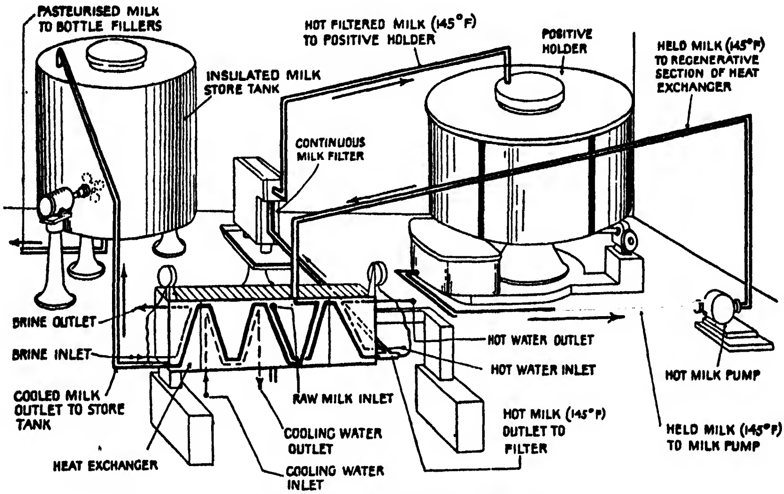


Fig. 5.—Diagram of Pasteurizing Plant
Reproduced by permission of the Aluminium Plant & Vessel Co., Ltd.

Continuous Positive Holding.

After the milk is raised in the heater to the required temperature, it passes to the holder tanks, where it is retained for the requisite time.

" The continuous positive holding process consists in filling a set of containers in turn with heated milk, leaving each container undisturbed for the premeditated holding time, and then discharging each in turn to an appropriate cooler." (Seligman.)

There are many forms of holder tank in use, but all are intended automatically to discharge the milk after half an hour's retention. " In some designs the tanks are sectors of a large cylinder which revolves slowly, each sector being filled or emptied automatically at definite positions during its rotation. In other modifications the

sectored cylinder is fixed and the automatic filling and discharging devices rotate."[1]

In the first-described holder, known as the "Tarbet Holder", the sectors are completely disconnected from the common filling and emptying devices except at the moment of charging or discharging: thus there is complete isolation of the milk being held, from the raw milk and from the milk that has already been held.

Where each container is fed through its own filling cock from a common main and emptied through the same or another cock or valve to a common discharging main, there is no guarantee that the held milk will not come in contact with the unheld milk. If emptying is done through the same cock or valve as filling, the pasteurized milk is liable to contamination in passing through the pipe used also for the raw milk. Further, a faulty valve might cause recontamination. Inlet and outlet valves are now generally kept apart and "leakage grooves" are provided to ensure that any milk escaping past a valve prematurely falls clear of the system.

It is essential that holder tanks should be efficiently insulated to prevent loss of heat during the holding period.

Vacuum Pasteurizing Process.—This process is as a rule employed only in large dairies. It eliminates the use ot milk pumps, all propulsion of milk being effected by vacuum or compressed air. From the beginning to the end of the process, the milk is in a closed circuit without exposure to the outer air. The whole cycle of operations is performed automatically. The milk should pass through no cocks or valves which require to be set either by hand or automatically.

Pasteurization in the Bottle.—Theoretically this ought to be the ideal method as it precludes subsequent contamination, but it is attended with difficulties in practice and is seldom used. There are, however, at present a few such plants in commercial operation.

SUPERVISION OF PASTEURIZATION

Under modern conditions it is important that medical officers of health and sanitary inspectors should have knowledge of the technical aspects of pasteurization as they are frequently called upon to exercise functions for which such knowledge is essential. If a pasteurizing plant is not giving satisfactory results, the following

[1] "Notes on the Pasteurization of Milk", by J. M. Hamill, O.B.E., M.D., D.Sc., *Ministry of Health Reports on Public Health and Medical Subjects*, No. 17.

advice on its inspection, by Sir Weldon Dalrymple-Champneys, Bt., will prove of value.[1]

"The problem confronting the medical officer of health or sanitary inspector is to discover at what point the process has broken down, and this is sometimes a very difficult point to determine. What are the possibilities? Well, first of all I should like to emphasize the fact that the *whole* process must be examined and not merely the *heating* process. It is not at all uncommon for a large bulk of milk which has been satisfactorily pasteurized to be recontaminated in the subsequent stages of handling.

"Some of the more important questions that the inspector must ask himself may be briefly summarized as follows:

1. "Is the raw milk to be treated reasonably clean? Pasteurization, as we have seen, does not sterilize the milk, nor does it make dirty milk clean, it merely reduces very considerably the number of organisms present.

2. "Is the apparatus efficiently cleaned and sterilized after each day's work? In this connexion I would warn the inspector not to accept vague statements such as that all the pipes are cleaned out with brushes and then sterilized with steam. It is important to know how the brushes themselves are cleaned, where they are kept after cleaning, how the steam is applied afterwards, and for how long, &c.

3. "How is the temperature of the milk determined during the holding process so as to make sure that the *whole* of the milk has been kept at 145° to 150° F. for not less than 30 minutes? In this connexion it may be well to point out that it is practically impossible to devise a thermometer or automatic recorder which will give the true temperature of every part of a large bulk of milk during the holding period, and attempts to do this are not only doomed to failure but usually involve heavy expense. This difficulty is, however, easily overcome by installing a reliable instrument in such a position as to record the temperature of the milk as it leaves the holder, when the passage of a quantity of insufficiently heated milk is easily detected. A small but important practical point often overlooked in this connexion is that the temperature indicating instrument, especially if it is a simple thermometer, should be placed in a position where it is easily seen. I remember one plant where nobody but a

[1] "Technical Methods and Devices in Connexion with the Pasteurization of Milk", by Sir Weldon Dalrymple-Champneys, Bt., Vol. LIII, No. 1 (1932) of the *Journal of the Royal Sanitary Institute.*

professional contortionist could possibly have obtained a view of the thermometer for more than a few seconds at a time and then only on a very sunny day! All plants should be fitted with temperature recording instruments, as they afford the only reliable means of temperature control.

4. " How is the holding time regulated? If by mechanical means, as is usual, the efficiency of the mechanism needs periodical checking.

5. " Is the holder efficiently insulated or otherwise protected from heat loss? If not, the milk must either drop below the required temperature before the end of the holding period or it must be overheated before entering the holder.

6. " Does any portion of the milk lie outside the holding zone during the half-hour of treatment? This is a common fault of the older types of apparatus and an important one, as a very small quantity of insufficiently heated milk can raise the bacterial count of a large batch above the statutory maximum. This is especially liable to occur with the foam which usually forms on the top of the milk and which, in a badly constructed holder, often escapes adequate heating and so contaminates the rest of the milk.

7. " Is there any possibility of *forward* leakage in the system, so that unpasteurized milk may gain access to the milk in the holder during the holding period or may escape forwards from the holder during the holding period and contaminate the treated milk which has already passed forward, or later the milk behind as it issues from the holder after treatment? A moment's consideration will show that *backward* leakage in the system is of relatively minor importance.

8. " Is the milk protected from contamination during the cooling process? I have been surprised to find how many open coolers are still in use, often working in a shed to which dust from the outside has free access. This protection of the milk during cooling is particularly important because, owing to the destruction of most of the lactic acid bacilli, extraneous organisms introduced at this stage have special opportunities for development.

9. " Is the milk protected from contamination during the filling process? In an efficient plant the filled bottles should be uncovered for the minimum time before capping.

10. " Are the bottles efficiently cleaned before being put into use again? As you all know, a bottle may be quite clean and bright to all appearance and yet have numerous micro-organisms adhering to its inner surface."

SUMMARY AND CONCLUSIONS

It must be admitted that, from the standpoint of public health, the milk supply of this country leaves much to be desired. No doubt considerable improvement has taken place in recent years, particularly in the quality and wholesomeness of the milk supplied by the larger distributors who, by means of pasteurization and otherwise, have done much to ensure the safety of their milk, and have thereby contributed to improvement of the public health.

The Producer Retailer.—It is estimated, however, that approximately half of the milk supply of the country is provided by a class of distributor known as the " producer retailer ", namely, a retailer dependent wholly or mainly on the milk produced by his own herd, which may be maintained on a farm in close proximity to the town or village where the milk is retailed, or sometimes within the town itself. Such producer retailers are generally in a small way of business, and cannot be expected to adopt all the methods, including pasteurization, employed by the large distributors to safeguard their supply.

Designated Milks.—The production of graded milk in Great Britain is small (less than 2 per cent of the total), and, although there has been a progressive increase in the number of producers, the increase in the case of the two higher grades during the last few years has been very slight. The educational effect of the grading scheme has, however, extended beyond the limited number of licences and has set a standard for progressive retailers which has undoubtedly tended to stimulate improvement in hygienic quality.

It is unfortunate that the designations do not indicate clearly the order of merit of the three grades. To the uninstructed, " Grade A " is often regarded as of the highest quality, " Grade A (T.T.) " as of lower quality by virtue of the qualification added to the previous designation, and " Certified " as the lowest of the three grades. The proper order is thus completely reversed.

There appears to be no good reason why the multiplicity of grades should be continued. They give rise to confusion and tend to limit the sale of graded milks. It would be in the interest both of the consumer and retailer if, in addition to the ordinary market milk, there were only one grade of raw designated milk. The public would then understand what they were being offered, and many would be prepared to pay the slightly higher price necessary. The

designation " Pasteurized " would, of course, continue to be officially recognized.

It is understood that the Milk Marketing Board propose to introduce a scheme for the production of a new grade of milk, termed " Accredited Milk ", which will be required to conform to a prescribed standard of purity, and will be produced by " Accredited Producers ". As an inducement to produce milk of this standard a bonus will be paid on every gallon of milk. Funds will be provided for the payment of the bonus by a levy on all producers of milk. Producer-retailers as well as wholesale producers will be encouraged to participate in the scheme. The object is not to produce a highly superior grade of milk of limited quantity, but to improve the standard of purity of the milk supplied to the great mass of the population.

The nature of the standard to be applied is not known, but it is understood that it will have regard to the condition of the farm, the health of the cow, the conditions of milking, and that the milk itself will be required to pass a bacteriological test.

Clean Milk.—The attention given to the production of " clean milk " during recent years has no doubt resulted in a general improvement in quality. The organization by County Education Authorities, with the assistance of the Ministry of Agriculture and Fisheries, of clean milk competitions, and the practice of some large distributing firms of giving monetary recognition to suppliers of milk of good quality, have had a marked effect in improving the cleanliness of milk, and this improvement could be enhanced were Local Authorities strictly to enforce the Milk and Dairies Order in all districts.

But strict attention to cleanliness, desirable and necessary as it certainly is, affords no guarantee that the milk is free from the risk of conveying tuberculosis or other infectious disease. The distinction between a " *clean* " and a " *safe* " milk should always be clearly borne in mind. (See page 355.)

TUBERCULOUS MILK

Endeavour should be made, as far as practicable, to eliminate the tubercle bacillus from raw milk. The eradication of tuberculosis from all the dairy herds in the country would be a formidable undertaking. It has been suggested that it might be accomplished by slaughtering all cattle that react to the tuberculin test, but as this would probably involve the slaughter of about half the cows in the country, it is not a measure likely to commend itself to the public,

particularly as it would only be a temporary remedy, because the remaining cows would sooner or later become infected, when the position would be as bad as ever. Short of such drastic measures, however, much could be done to reduce the amount of tuberculous milk sold to the public by:

(*a*) **Routine Inspection of Dairy Cattle.**—It appears probable that periodic routine inspection of dairy cattle by whole-time veterinary inspectors would detect a fair proportion of the cows yielding tuberculous milk, and considerable improvement would be effected if all County Councils established such a system of inspection in their areas. It is understood that the routine inspection of dairy cattle is undertaken in only eleven English counties at present. In cases in which the results of the clinical examination are uncertain a sample of the milk of the suspected cow should be subjected to bacteriological examination. While the biological test is the most reliable, microscopic examination may afford useful information in respect of the milk of one cow. If the presence of the tubercle bacillus is detected by the latter method, it enables a diagnosis to be made without delay. On the other hand, a negative result cannot by itself be accepted as conclusive evidence that the milk is free from tubercle bacilli.

(*b*) **Sampling of Milk for the Detection of the Tubercle Bacillus.**—In addition to the routine clinical examination of herds, and any bacteriological examination connected therewith, it is important that samples of mixed milk should from time to time be taken and subjected to the biological test for the detection of tubercle bacilli.

Each sample should be derived from the milk of one herd only, and it should, if practicable, be taken at some stage before mixing with other milk occurs, namely, at the farm or on arrival at a country depot.[1]

The number of samples which it is desirable to take from each herd in the course of a year may depend somewhat on the frequency of the veterinary inspections; but by one method or the other each herd should be kept under adequate observation.

Section 3 of the Milk and Dairies (Consolidated) Act, 1915, requires the veterinary inspection of any herd from which tuberculous milk is known to have been derived, and all cows yielding such

[1] This is of importance having regard to the fact that milk is frequently collected at country depots where it is "bulked" and transported, either by road or rail, to London or elsewhere, in large glass-lined tanks containing about 3000 gallons. As the contents of one tank may be derived from a large number of farms (perhaps 100 or more), if the presence of the tubercle bacillus be detected in a sample taken from such a tank it will be difficult or impossible to trace its source.

milk should be slaughtered under the provisions of the Tuberculosis Order, 1925.

Both County Councils and Sanitary Authorities are empowered to take samples of milk and submit them to bacteriological investigation with a view to the detection of the tubercle bacillus. While County Councils are no doubt primarily responsible for sampling and bacteriological examinations, there would be advantage if they co-operated with the Sanitary Authorities in the county so as to secure adequate sampling in all parts of the area.

(*c*) **Pasteurization.**—If efficiently carried out, pasteurization destroys tubercle bacilli and other pathogenic organisms, and affords the most reliable means of safeguarding the milk supply. A very large proportion of the milk sold in cities, such as London, Manchester and Glasgow, is pasteurized, and from the public health standpoint all practicable steps should be taken to encourage efficient pasteurization.

MILK PRODUCTS

Cream

Cream may be derived from milk by placing the latter in large open pans and allowing it to stand until the cream rises to the surface, when it is " skimmed " by hand. The bacterial count of such cream is relatively high, as the bacteria tend to rise to the surface along with the cream. It is usual, however, to abstract cream from milk in an apparatus known as a " separator ", the milk being received into a circular receptacle, known as the drum, which is rotated at high speed. By centrifugal action, the heavier part of the milk is driven to the outside of the receptacle, leaving the cream in the inner or central portion. The " skim " milk leaves the apparatus by one outlet and the cream by another. The separation of the cream is more complete by this method and practically no butter fat remains in the separated milk.

Cream contains about 40–50 per cent of butter fat and clotted cream rather more. As it is now illegal to add preservatives to cream,[1] it is frequently pasteurized to improve its keeping qualities, particularly during the summer months.

Clotted Cream is extensively made in Devon and Cornwall. It is prepared by placing milk in large shallow pans. When the cream has risen to the surface, the pans are placed on a stove or in a " steamer " and the milk is " scalded ", hence the name " scalded cream ". As soon as blisters begin to rise on the surface of the cream the pans are removed from the stove, or steamer, and allowed to cool, when the cream is " skimmed " and put into crocks or other receptacles.

[1] Public Health (Preservatives, &c., in Food) Regulations.

Artificial Cream is an emulsion of milk with either fresh milk or dried skimmed milk and water. The Artificial Cream Act, 1929, requires the receptacles in which artificial cream is offered for sale to be legibly marked or labelled " artificial cream ", and premises in which it is manufactured, or sold, to be registered.

MILK POWDER

Many processes have been devised and patented for the manufacture of " dried milk ". The following are the more important:

1. ROLLER DRYING.—In this process the milk in the form of a thin film is dried on revolving metal drums or rollers, which are heated internally by hot water or steam. The dried film of milk is automatically removed by means of a scraper. With the view of increasing the rate of evaporation and reducing the working temperature the process is sometimes conducted in a partial vacuum. It is claimed that the lower temperature employed in this method ensures greater solubility of the powder.

2. SPRAY DRYING.—In this process drying is effected by bringing milk in the form of a very fine spray into contact with a current of hot air.

3. DOUGH DRYING.—Precondensed milk is spread in thin layers on trays and dried in hot air chambers, or it may be passed on a carrier belt through a hot air chamber.

CONDENSED MILK

1. " **Sweetened Condensed Milk** is the viscous fluid obtained by condensing cows' milk so that 2 lb. to 2¾ lb. of fresh milk yield 1 lb. of condensed milk, succrose being added in sufficient quantity to preserve the finished product. It is marketed either in hermetically sealed tins for small consumers, or in closed wooden barrels for bulk purchasers."

" The milk received at the factory is first weighed, filtered, or clarified, cooled and run into large holding tanks. Samples are then abstracted from these for determination of fat and solids-non-fat, and an amount of cream or separated milk (as the case may be) added, if necessary, in order to ensure that the resulting product shall contain the standard quantities of fat and solids-non-fat. The standardized milk is then pumped into the milk supply tank, and from this it flows through a forewarmer into the sugar mixing pan."

" The mixed milk and sugar are subsequently pumped into a vacuum pan, where the mixture is condensed under reduced pressure to the required concentration (determined by sampling). When this process is complete, the batch of condensed milk is pumped into a cooling tank and then filled into tins or barrels."

2. " **Evaporated or Unsweetened Condensed Milk** is obtained

by condensing cows' milk in vacuo, by a process similar to that used for sweetened condensed milk. It differs from the latter in the fact that no sugar is added as a preservative. Instead it is sterilized by heat after the completion of the condensing process, and it is marketed in the hermetically sealed tins in which it was sterilized."

"The milk is weighed, filtered, cooled, standardized to the required fat and solids-non-fat content, forewarmed and then condensed in a vacuum pan, by methods previously described under "Sweetened Condensed Milk". The condensed milk is then passed through a homogenizer; it is cooled and led into storage tanks, from which it is pumped into a filling machine and filled into tins which are immediately sealed. These tins of evaporated milk are then sterilized by heating with steam under pressure."[1]

BUTTER

Butter is prepared by churning cream, though whole milk is sometimes used for the purpose. Before churning, the cream is generally allowed to stand for some hours in order that it may "ripen" or become sour. The ripening process is produced by the action of lactic acid bacteria, and, as different species, or strains, of these bacteria produce different flavours in the butter, it is usual to ripen the cream with a "starter", namely, a pure culture of an organism known to produce butter of good flavour and aroma.

During churning, the fat globules of the milk are ruptured and the freed fat coalesces into granular particles which, when the process is completed, appear like grains of mustard seed floating in the buttermilk. The latter is then drawn off through a hair sieve and the butter washed in the churn, first with cold water and afterwards with brine. The butter is then removed from the churn to the "butter-worker", where all surplus moisture is expelled. When dry and firm the butter is "made up" on a butter board into various shapes, half-pound rectangular blocks being a common form; wooden butter pats (called "Scotch hands") are used in the process.

The percentage composition of butter is approximately: fat 84, casein 1, salt, &c., 2, and water 13. Butter fat is a mixture of the glycerides of certain volatile fatty acids, particularly butyric, palmitic, and oleic. The percentage of soluble volatile fatty acids in butter fat serves to distinguish it from the majority of other fats, animal or vegetable.

Butter may be adulterated by admixture with other fats or by the presence of excessive amounts of moisture. A limit of 16 per cent of moisture is fixed by the Food and Drugs Adulteration Act. No preservative may now be added to butter, but the use of common salt is per-

[1] Hannah Dairy Research Institute, "The Properties of Milk in relation to the Condensing and Drying of Whole Milk, Separated Milk, and Whey", by L. A. Allen. 1932.

mitted. Butter has frequently been found to contain the tubercle bacillus and, for this reason, butter made from pasteurized cream is preferable. A temperature of 145°–150° F. for half an hour destroys all pathogenic organisms and does not materially affect the butter-making qualities of the cream.

MILK-BLENDED BUTTER is now little used in Britain. It is generally made from imported butter into which an additional amount of milk has been worked in this country.

MARGARINE

Margarine is defined as any article of food, whether mixed with butter or not, which resembles butter and is not milk-blended butter.[1] It is made from refined animal and vegetable fats combined with milk which imparts the flavour of butter. In recent years vegetable oils such as cocoanut, cotton seed, &c., have been increasingly employed in the manufacture of margarine. These oils differ from butter fat in that they contain only a trace of soluble volatile fatty acids, being composed for the most part of the glycerides of oleic, palmitic and stearic acids. Margarine tends to be deficient in vitamins, but it is claimed that by means of irradiation margarine can now be produced with the same vitamin content as summer butter, and in the case of certain brands this appears to be the case.

Margarine must not contain more than 16 per cent of moisture or 10 per cent of butter fat.[2]

CHEESE

Cheese consists of casein with varying proportions of fat and salts. There are many kinds of cheeses; some are made from whole milk (e.g. Cheddar), some from skim milk (e.g. some Dutch cheeses), and some from whole milk to which cream has been added (e.g. Stilton). In the preparation of cheese the milk may be clotted by the action of rennet, or by being allowed to become sour, or by the addition of acid. The curd is generally subjected to pressure to remove the whey which it contains. High pressure is used for hard cheeses and a lower pressure for soft cheeses. Cheddar, Chester, Edam, and Gouda are examples of hard cheeses, and Cream, Camembert, Stilton, and Gorgonzola of soft cheeses.

After being subjected to pressure the curd is set aside to "ripen". Ripening is due to the action of bacteria, and the flavour of cheese is dependent upon the species of micro-organism which has gained access to it during ripening; each species producing chemical bodies which give to the particular kind of cheese its peculiar characteristics. Much may

[1] See above. [2] See p. 407.

now be done in improving the quality of cheese by introducing suitable organisms as " starters " at an appropriate stage of the process of manufacture.

Cheese should not contain fat derived otherwise than from milk. " Margarine cheese " is any substance prepared in imitation of cheese which contains fat not derived from milk.

Section VIII.—Summary of Acts, Regulations, and Orders relating to Inspection of Food, Prevention of Contamination, and Seizure and Condemnation of Unsound Food: Slaughter-houses: Imported Food: Purity of Food and Drugs: Hygiene of Milk and Dairies: Fish and Shellfish.

Abbreviations used in this Section

Adoptive.	An Act that may be adopted by a Sanitary Authority.
C.C.	County Council.
D.O.	Detention Officer.
D. of H. (Scotland).	Department of Health for Scotland.
F.D.A.	Food and Drugs Authority.
I.	Inspector.
L.A.	Local Authority.
L.C.C.	London County Council.
M.I.	Meat Inspector.
M. of A. and F.	Ministry of Agriculture and Fisheries.
M. of H.	Ministry of Health.
M.O.H.	Medical Officer of Health.
O.C.	Officer of Customs and Excise.
P.S.A.	Port Sanitary Authority.
S.A.	Sanitary Authority.
S.D.	Sanitary District.
Sec.	Section.
S.I.	Sanitary Inspector.
S.O.	Sampling Officer.
T.C.	Town Council.
U.A.	Urban Authority.
V.I.	Veterinary Inspector.
V.S.	Veterinary Surgeon.
P.H.	Public Health.
P.H.A.	Public Health Act.
Act of 1847.	Towns Improvements Clauses Act, 1847.
Act of 1875.	Public Health Act, 1875.
Act of 1890.	Public Health Acts Amendment Act, 1890.
Act of 1891.	Public Health London Act, 1891.

CHAPTER I

Inspection of Food, Prevention of Contamination, and Seizure and Condemnation of Unsound Food, &c.

ENGLAND AND WALES (including London): Public Health Meat Regulations, 1924.

ENGLAND AND WALES (excluding London): Public Health Act, 1875, Secs. 116, 117, 118, and 119—Public Health Acts Amendment Act, 1890, Sec. 28—Markets and Fairs Clauses Act, 1847, Secs. 15, 20, and 42—Towns Improvement Clauses Act, 1847, Sec. 131—Public Health Act, 1925, Secs. 72 and 73. —Public Health (Infectious Diseases) Regulations, 1927, Part III.

LONDON: Public Health London Act, 1891, Sec. 47– City of London Sewers Act, 1851, Secs. 26 and 27—City of London Various Powers Act, Sec. 39—London County Council (General Powers) Act, 1908—The Infectious Diseases (London) Regulations, 1927, Part III.

SCOTLAND: Public Health (Scotland) Act, 1897, Sec. 43 — Public Health (Meat) Regulations (Scotland), 1932.

GREAT BRITAIN: Sale of Horse-flesh, &c., Regulations Act, 1889.

England and Wales (including London)

The Public Health (Meat) Regulations, 1924

PART I.—GENERAL

2.—(1) In these Regulations, unless the context otherwise requires:

"The Minister" means the Minister of Health;

"Local Authority" means the Common Council of the City of London, the Council of a Metropolitan Borough, the Council of a Municipal Borough or other Urban District, the Council of a Rural District or the Council of the Isles of Scilly;

"Medical Officer of Health" includes any person temporarily acting in that capacity;

"Inspector" means the M.O.H. or any other Officer of a L.A., having under the Acts relating to Public Health or any Local Act power to inspect and examine meat intended for the food of man;

"Meat" means the flesh of cattle, swine, sheep, or goats, including bacon and ham and edible offal and fat, which is sold or intended for sale for human consumption, and "animal" means any animal from which meat is derived;

"Slaughter-house" means such part of a slaughter-house, as defined in Section 4 of the Public Health Act, 1875, as is used for the slaughtering of animals or the dressing or hanging of carcasses for human consumption;

"Stall" includes any stall barrow or vehicle from which meat is offered for sale in a street or other open space or in any market place;

"Room" includes a shop cellar passage or other place forming the whole or part of a building other than a slaughter-house as above defined;

"Vehicle" includes a railway or other van or waggon and a ship or barge but does not include any separate compartment thereof in which meat is not being conveyed.

(2) The Interpretation Act, 1889, applies to the interpretation of these Regulations as it applies to the interpretation of an Act of Parliament.

3. The L.A. shall enforce and execute the provisions of these Regulations in their district:

Provided that a P.S.A. shall also be an authority for enforcing and executing the provisions of Part VI within their district.

4. The M.O.H., the S.I. and any other officer of a L.A. or P.S.A. duly authorized by the Authority in writing shall for the purpose of ascertaining whether these Regulations are being observed have power at all reasonable times to enter and inspect any slaughter-house, room or other place and any stall or vehicle to which these Regulations apply.

5. A person shall, if so required, give to any officer of a L.A. acting in the execution of these Regulations, all reasonable assistance in his power, and shall, in relation to anything within his knowledge, furnish any such officer with all information he may reasonably require for the purposes of these Regulations.

6. No person who is for the time being suffering from an infectious disease to which the Infectious Disease (Notification) Act, 1889, applies shall take part in the slaughtering of animals intended for human consumption or the handling of meat.

Part II.—Slaughter-houses and Slaughtering

7.—(1) This part of these Regulations shall not apply so as to interfere with the operation or effect of the Diseases of Animals Acts, 1894 to 1922, or of any Order, licence or act of the M. of A. and F., made, granted or done thereunder.

(2) Articles 8, 9, 10 and 11 of these Regulations shall not apply where the slaughter takes place in a slaughter-house under the management of a L.A.

8. A person shall not slaughter an animal for sale for human consumption unless he has not less than three hours before the time of slaughtering delivered or caused to be delivered to the L.A. notice of the day and time and of the place on and at which the slaughtering will take place:

Provided that—

(1) Where it is the regular practice in any slaughter-house to slaughter animals at fixed times on fixed days and written notice of this practice has been given to the L.A. special notice under this Article shall not be required to be given in respect of any animal slaughtered in accordance with such practice;

(2) Where by reason of accidental injury, illness, or exposure to infection, it is necessary that an animal should be slaughtered without delay, the provisions of this Article shall be deemed to be satisfied if notice of the slaughter is given to the L.A. as soon as reasonably possible, whether before or after the slaughtering takes place.

9. Where on the slaughter of an animal for sale for human consumption it appears that any part of the carcass or internal organs is or may be diseased or unsound the person by or on whose behalf the animal was slaughtered shall forthwith give notice of the fact to the L.A.

10. Except as hereinafter provided, the person by or on whose behalf an animal is slaughtered for sale for human consumption, shall not cause or permit the carcass of the animal, including the mesentery and internal organs other than the stomach, intestines and bladder, to be removed from the place of slaughter until such carcass with its organs has been inspected, or its removal has been authorized, by an I. of the L.A.

Provided that—

(1) This Article shall not apply in the case of a sheep or in the case of any animal in respect of whose slaughter special notice is not required to be given by reason of proviso (1) to Article 8, unless some part of the carcass or organs appears to be diseased or unsound;

(2) The removal may in any case take place at the expiration of three hours from the time of slaughter or six hours from the delivery of any notice relating thereto under Article 8 or 9 whichever time may be later, save that if such time falls between 7 p.m. on one day and 7 a.m. on the next day, the removal shall not take place before 7 a.m.;

(3) Where the animal was slaughtered by reason of accidental injury and the place of slaughter is unsuitable for the retention of the carcass, the carcass and organs may be removed to some convenient place, but the notice required to be given under Article 8 shall be given to the L.A. in whose district that place is situated and Article 8 of these Regulations shall have effect as if that place were substituted for the place of slaughter.

11.—(1) The notices to be given to the L.A. under Articles 8 and 9 of these Regulations shall be given to such officer and delivered at such address as the L.A. may direct and in the absence of any such direction shall be given to the M.O.H. and delivered at his office. The effect of any direction given under this paragraph shall be communicated to the occupier of every slaughter-house in the district and published in one or more local newspapers circulated within the district.

(2) Any such notice, other than a notice of regular slaughtering, may be given orally; and any such notice may be served by letter addressed to the proper officer and delivered at, or prepaid and posted to, the proper address, and in the case of a notice sent by post shall for the purposes of these Regulations be deemed to have been delivered at the time at which it would have been delivered in the ordinary course of the postal service.

12.—(1) No gut-scraping, tripe-cleaning, manufacture or preparation of articles of food for man or for animals, household washing or work of any nature other than is involved in the slaughter and the dressing of carcasses, shall be carried on in any slaughter-house.

(2) No articles shall be stored in any slaughter-house except such implements, appliances, receptacles and other articles as are required for the slaughter of animals and processes directly connected therewith, including the dressing, hanging and storage of carcasses, the cleansing of the slaughter-house and the removal of refuse.

13. No person shall blow or inflate with his breath, or in any other manner

likely to cause infection or contamination, the carcass or any part of the carcass of any animal slaughtered for human consumption.

14. No person shall use a slaughter-house for the slaughter of any animal which previous to slaughter is not intended for human consumption.

Part III.—Meat Marking

15.—(1) Where a L.A. show to the satisfaction of the Minister that they have made suitable arrangements (including the appointment or employment of competent Inspectors) for the inspection of animals at the time of slaughter, the Minister may, on the application of the L.A., and subject to such conditions, if any, as he may impose, authorize them to use for the purpose and in the manner specified in these Regulations a distinctive mark of a design approved by him and so devised as to indicate the identity of the L.A. and of the I. using the mark.

(2) An I. of a L.A. whose mark has been approved by the Minister shall not affix or impress the same to or on any part of the carcass of an animal slaughtered for the food of man unless he has inspected the whole carcass with the organs in position and such part has appeared to him to be free from disease, sound, wholesome and fit for the food of man.

(3) The L.A. and their Is. shall comply with any directions given by the Minister as to the use of such mark, and they shall not cause the mark to be affixed to or impressed on any carcass except at the request or with the consent of the person having possession of the carcass at the time of inspection.

(4) The Minister may at any time revoke his authorization of the use of a mark or his approval of a mark adopted as aforesaid.

16. No L.A. shall use or permit to be used a mark indicating that the carcass or any part of the carcass of an animal for human consumption has been inspected unless they have been authorized and such mark has been approved by the Minister and such authorization and approval have not been revoked.

17. No person other than an I. of a L.A. authorized as aforesaid shall make use of a mark adopted and approved as aforesaid, and no person shall make use of any mark so resembling a mark adopted and approved as aforesaid as to be calculated to deceive.

18.—(1) The L.A. may determine the charges (if any) to be made for the marking of carcasses either according to the number of carcasses marked or on such other basis as they may think fit, but the charge so determined shall not in any case exceed a sum calculated at the rate of one shilling for each carcass or part of a carcass marked.

(2) Any such charge shall be recoverable summarily as a civil debt from the person requesting or consenting to the marking.

Part IV.—Stalls

19. A person selling meat or exposing or offering meat for sale from any stall—

(*a*) shall keep his name and address legibly painted or inscribed on such stall in some conspicuous position;

(*b*) shall cause such stall (if not placed in an enclosed and covered market place) to be suitably covered over and to be screened at the sides and back thereof in such a manner as to prevent mud, filth or other contaminating substance being splashed or blown from the ground upon any meat on the stall;

(*c*) shall cause every counter, slab, vessel or other article on or in which meat is placed for sale and all knives and other implements used in

connexion with the meat to be thoroughly cleansed after use and to be kept at all times in a cleanly condition;

(*d*) shall take all such steps as may be reasonably necessary to guard against the contamination of the meat by flies;

(*e*) shall not place or cause to be placed any meat on, or within eighteen inches of the ground or floor, unless the meat is placed in a closed cupboard or other adequately protected space not less than nine inches from the ground or floor;

(*f*) shall cause all trimmings, refuse and rubbish to be placed in properly covered receptacles kept for the purpose apart from any meat intended for sale.

PART V.—SHOPS, STORES, ETC.

20.—(1) The occupier of any room in which any meat is sold or exposed for sale or deposited for the purpose of sale or of preparation for sale or with a view to future sale, and any person who knowingly lets any room or suffers any room to be occupied for such purpose shall cause the following provisions to be complied with:—

(*a*) No urinal, water-closet, earth-closet, privy, ashpit or other like sanitary convenience shall be within such room or shall communicate directly therewith, or shall be otherwise so placed that offensive odours therefrom can penetrate to such room;

(*b*) No cistern for supplying water to such room shall be in direct communication with or directly discharge into any such sanitary convenience;

(*c*) No drain or pipe for carrying off fæcal or sewage matter shall have any inlet or opening within such room unless it is efficiently trapped;

(*d*) No such room shall be used as a sleeping place, and, so far as may be reasonably necessary to prevent risk of the infection or contamination of any such meat as aforesaid, no sleeping place shall communicate directly with such room.

(*e*) Except in the case of a room used as a cold store, adequate means of ventilation shall be provided.

(2) The occupier of any such room shall not cause or suffer any refuse or filth whether solid or liquid to be deposited or to accumulate therein except so far as may be reasonably necessary for the proper carrying on of the trade or business.

(3) Such occupier shall cause the walls and ceiling of such room to be whitewashed, cleansed or purified as often as may be necessary to keep them in a proper state.

(4) Such occupier and every other person engaged in such room shall observe due cleanliness in regard to such room and all articles, apparatus and utensils therein.

(5) The occupier of any such room—

(*a*) shall take all such steps as may be reasonably necessary to guard against the contamination of the meat therein by flies and shall cause the meat to be so placed as to prevent mud, filth or other contaminating substance being splashed or blown thereon;

(*b*) shall not permit any gut-scraping, tripe-cleaning or household washing to be carried on therein;

(*c*) shall cause every counter, slab, vessel or other article on or in which meat is placed for sale and all knives and other implements used in connexion with the meat to be thoroughly cleansed after use and to be kept at all times in a cleanly condition;

(*d*) shall cause all trimmings, refuse and rubbish to be placed in properly covered receptacles kept for the purpose apart from any meat intended for sale.

Part VI.—Transport and Handling

21.—(1) Every person who conveys or causes to be conveyed any meat in a vehicle—

(a) shall cause to be kept clean the inside and covering of the vehicle, the receptacles in which the meat is placed, and such parts of any slings or other implements or apparatus used for loading or unloading as come into contact with the meat or its covering; and

(b) if the vehicle is open at the top, back, or sides or if any other commodity is being conveyed therein, shall cause the meat to be adequately protected by means of a clean cloth or other suitable material;

(c) shall not permit any live animal to be conveyed in the vehicle at the same time as meat.

(2) A person engaged in the handling or transport of meat,—

(a) shall not permit any part of the meat to come into contact with the ground; and

(b) shall take such other precautions as are reasonably necessary to prevent the exposure of the meat to contamination.

(3) Every person who employs a person to carry meat in or about a market or other place in which meat is sold by wholesale or in or about any place wholly or mainly used for the storage of meat before it is distributed to retailers, shall cause such person while so occupied to wear, and every person while so occupied shall wear, a clean and washable head covering and overall.

(4) This Article shall not apply to any meat which is packed in hampers or other strongly constructed and impervious cases or is adequately wrapped in jute or some other stout fabric.

England and Wales (excluding London)

Public Health Act, 1875

Power of M.O.H. and S.I. to inspect Meat, etc.

Sec. 116.—Any M.O.H. or S.I. may at all reasonable times inspect and examine any animal, carcass, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or milk exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and intended for the food of man, the proof that the same was not exposed or deposited for any such purpose, or was not intended for the food of man, resting with the party charged; and if any such animal, carcass, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour or milk appears to such M.O.H. or S.I. to be diseased or unsound or unwholesome or unfit for the food of man, he may seize and carry away the same himself or by an assistant, in order to have the same dealt with by a justice.

Power of Justice to order Destruction of Unsound Meat, etc.

Sec. 117.—If it appears to the justice that any animal, carcass, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or milk so seized is diseased or unsound or unwholesome or unfit for the food of man, he shall condemn the same, and order it to be destroyed or so disposed of as to prevent it from being exposed for sale or used for the food of man; and the person to whom the same

belongs or did belong at the time of exposure for sale, or in whose possession or on whose premises the same was found, shall be liable to a penalty not exceeding twenty pounds for every animal, carcass, or fish, or piece of meat, flesh or fish, or any poultry or game, or for the parcel of fruit, vegetables, corn, bread or flour, or for the milk so condemned, or, at the discretion of the justice, without the infliction of a fine, to imprisonment for a term of not more than three months.

The justice who, under this section, is empowered to convict the offender, may be either the justice who may have ordered the article to be disposed of or destroyed, or any other justice having jurisdiction in the place.

Penalty for hindering Inspection

Sec. 118.—Any person in any way preventing or obstructing the M.O.H. or S.I. in the discharge of his duty is liable to a penalty not exceeding £5.

Search Warrant may be granted by a Justice

Sec. 119.—If the M.O.H., S.I., or other official of the S.A. makes a statement on oath that he suspects there is kept or concealed in any premises, any animal, or any article previously specified, which is intended for the food of man and which is diseased or otherwise unfit for that purpose, a justice may grant a warrant of entry on such premises, and power to search for and seize the articles, &c., so that they may be dealt with. Any person obstructing is subject to a penalty not exceeding £20.

Note.—It will be noted that such important articles of food as butter, eggs, cheese, &c., are not mentioned. Further, no proceedings can be taken in regard to articles already sold. The Public Health Acts Amendment Act, 1890, remedies these defects.

Public Health Acts Amendment Act, 1890 (Adoptive)

Sec. 28 extends the scope of Secs. 116 to 119 of the 1875 Act to all articles intended for the food of man sold or exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and also empowers a justice to condemn articles if satisfied they are unfit for food even though they have not been seized as mentioned in Sec. 116.

The Market and Fairs Clauses Act, 1847

Sec. 15 gives powers similar to those of the Act of 1875 for the seizure of unwholesome meat or other provisions in markets and fairs. (So far as it relates to markets this section is in force in all urban districts by incorporation with Sec. 167 of the Act of 1875, and in rural districts in cases where the powers of Sec. 167 are being exercised with the consent of the M. of H. under Sec. 1 of the P.H. Act, 1908. The Act of 1847 may also be incorporated with any Local Act authorizing the construction or regulation of a market or fair. It is also incorporated, except as regards Secs. 6 to 9 and 51 to 60, with the Diseases of Animals Act, 1894).

Sec. 42 (which, so far as it relates to markets, is also incorporated with the P.H. Act, 1875, by Sec. 167) authorizes the making of bye-laws for, *inter alia*, preventing the sale of unwholesome provisions in a market or fair.

Sec. 20 gives powers for the seizure of unsound meat in places provided under the Act for the slaughtering of cattle. (This Section is incorporated with the Diseases of Animals Act, 1894. Local Authorities under that Act comprise Councils of Boroughs having at the Census of 1881 a population of 10,000 or upwards, and elsewhere, County Councils.)

Towns Improvement Clauses Act, 1847

"SEC. 131 authorizes the seizure of unsound meat in slaughter-houses and places kept for the sale of butcher's meat. It will be noted that under this provision it is not necessary to show that the meat seized is intended for sale, but only that it is unfit for the food of man. Further, the power of seizure is not restricted to the M.O.H. or S.I., but extends to any other officer appointed by the L.A. for that purpose."

Public Health Act, 1925

PRECAUTIONS AGAINST CONTAMINATION OF FOOD INTENDED FOR SALE

SEC. 72.—(1) This section applies to any room, not being a room to which the Factory and Workshop Act, 1901, as amended by any subsequent enactment or any regulation made under the Public Health (Regulations as to Food) Act, 1907, applies, in which food is prepared for sale, or in which any food, other than food contained in receptacles so closed as to exclude all risk of contamination, is sold or is stored or kept with a view to future sale.

(2) The occupier of any room to which this section applies shall not permit the room to be used for the purpose of selling, preparing, storing, or keeping any food unless the following requirements are complied with, that is to say:

(*a*) No sanitary convenience shall be in the room, or shall communicate directly therewith, or shall be so placed that offensive odours therefrom can penetrate to the room.

(*b*) No cistern for the supply of water to the room shall be in direct communication with or discharge directly into any sanitary convenience.

(*c*) No outlet for the ventilation of any drain shall be in the room, and if there is in the room any inlet or opening into any drain, that inlet or opening shall be efficiently trapped.

(*d*) The room shall not be used as a sleeping place, and no sleeping place shall communicate directly with the room in such manner as to cause unreasonable risk of contamination to food in the room.

(*e*) The room shall, except in the case of a room used as a cold store, be adequately ventilated.

(3) The occupier of any room to which this section applies shall—

(*a*) cause the walls and ceiling of the room to be whitewashed, cleansed, or purified as often as may be necessary to keep them in a clean state; and

(*b*) prevent any unnecessary accumulation or deposit of refuse or filth in the room.

(4) The occupier of any room to which this section applies and every person engaged in any such room shall take all such steps as may be reasonably necessary on his part to prevent risk of contamination to food in the room and to secure the cleanliness of the room and of all articles, apparatus, and utensils therein.

(5) The M.O.H., S.I., and any other officer of a L.A. duly authorized in writing by the authority in that behalf shall have power at all reasonable times to enter and inspect any room to which this section applies for the purpose of ascertaining whether the provisions of this section are complied with.

(6) If any person acts in contravention of or fails to comply with any of the provisions of this section, or hinders or obstructs an officer of a L.A. in the exercise of his powers or duties under this section, he shall be liable to a penalty not exceeding 20*s*. for the first offence or not exceeding £5 for any subsequent offence and in either case to a daily penalty not exceeding 20*s*.

(7) In this section the expression—

"food" includes every article used for food or drink by man other than drugs or water, and any article which ordinarily enters into or is used in the composition or preparation of human food, and flavouring matters and condiments;

"room" includes any shop, shed, store, out-building, or cellar;

"sanitary convenience" includes urinals, water-closets, earth-closets, privies, ashpits, and any similar convenience.

RAG AND BONE DEALERS NOT TO SELL FOOD OR TOYS

SEC. 73.—(1) It shall not be lawful for any collector of or dealer in rags or bones or similar articles, or any person carrying on the business of a rag and bone merchant, or any person acting on behalf of any such person, to sell or distribute within the district of the L.A. from any cart, barrow or other vehicle used for the collection of rags, bones or similar articles, or in or from any shop or premises used for, or in connexion with, the business of a rag and bone merchant any article of food or any balloon or other toy.

(2) Every person who shall offend against this section shall be liable to a penalty not exceeding £5.

Public Health (Infectious Diseases) Regulations, 1927

PART III.—ENTERIC FEVER AND DYSENTERY

1.—(i) In any case of enteric fever or dysentery occurring in his District of which the M.O.H. becomes aware, and in connexion with which he is of opinion after inquiry that such a course is necessary to prevent the spread of infection, he shall report accordingly to the L.A. who may by notice in writing require that, until a further notice in writing is given by them revoking the first mentioned notice on the ground that the risk of infection is removed—

(*a*) the person specified in the notice shall discontinue any occupation connected with the preparation or handling of food or drink for human consumption;

(*b*) suitable measures to be specified in the notice shall be taken with respect to cleansing, disinfection, disposal of excreta, destruction of flies, and prevention of contamination of articles of food or drink for human consumption.

(ii) The notice may be addressed to the head of the family to which the patient belongs, or to any person in charge of or in attendance on the patient, or to any other person in the building or place of which the patient is an inmate, or to the occupier of the building or place.

2.—(i) If a M.O.H. has grounds for suspecting that any person in the district who is employed in any trade or business concerned with the preparation or handling of food or drink for human consumption is a carrier of enteric fever or dysentery infection, he shall report accordingly to the L.A., who may give notice in writing to the responsible manager of the trade or business concerned certifying that for the purpose of preventing the spread of the disease they consider it necessary for their M.O.H. or a Medical Officer acting on his behalf to make a medical examination of such suspected person, and the responsible manager and all other persons concerned shall give to the M.O.H. all reasonable assistance in the matter.

(ii) If from the result of any such examination, or from bacteriological or protozoological examination of material obtained at any such examination, or from any

other evidence which he may deem sufficient for the purpose, the M.O.H. is of opinion that the specified person is a carrier of enteric fever or dysentery infection, the M.O.H. shall report to the L.A. who may give a notice in writing to that effect to the responsible manager and to the suspected person with a view to preventing during a period to be specified in such notice, the employment of the person to whom the notice relates in the conduct of the trade or business, or in any other trade or business concerned with the preparation or handling of food or drink for human consumption.

NOTE.—By Article 17 of the Regulations the provisions of Sec. 308 of the P.H. Act, 1875 (which relates to compensation for damages sustained by reason of the exercise of the powers of the Act), are made applicable to any person who sustains any damage by reason of the exercise of any of the powers of these Regulations in relation to any matter as to which he is not himself in default.

London

Public Health (London Act), 1891

" SEC. 47 of this Act authorizes the M.O.H. or S.I. of a Metropolitan Borough Council or of the Common Council of the City of London to inspect food exposed for sale, or deposited in any place for the purpose of sale or of preparation for sale, and to seize and carry before a justice for condemnation any such article which appears to be diseased, unsound, unwholesome, or unfit for the food of man. The provisions of this section are somewhat wider than the corresponding provisions of the P.H. Act, 1875, e.g. under subsection (1) the M.O.H. or S.I. is given power to ' enter any premises ' as well as to ' inspect and examine '; under subsection (3) action may be taken against the person from whom the unsound food was purchased; and under subsection (8) a person who finds himself in the possession of unsound food may request the S.A. to remove it as if it were trade refuse."

Subsections (1), (3), and (8) of Sec. 47 of the Act of 1891 are given below:

SEC. 47.—(1) Any M.O.H. or S.I. may at all reasonable times enter any premises and inspect and examine—

(*a*) any animal intended for the food of man which is exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and

(*b*) any article, whether solid or liquid, intended for the food of man, and sold or exposed for sale or deposited in any place for the purpose of sale or of preparation for sale,

the proof that the same was not exposed or deposited for any such purpose, or was not intended for the food of man, resting with the person charged; and if any such animal or article appears to such M.O.H. or S.I. to be diseased, or unsound, or unwholesome, or unfit for the food of man, he may seize and carry away the same himself or by an assistant, in order to have the same dealt with by a justice.

(3) Where it is shown that any article liable to be seized under this section, and found in the possession of any person, was purchased by him from another person for the food of man, and when so purchased was in such a condition as to be liable to be seized and condemned under this section, the person who so sold the same shall be liable to the fine and imprisonment above-mentioned, unless he proves that at the time he sold the said article he did not know, and had no reason to believe, that it was in such condition.

(8) Where a person has in his possession any article which is unsound or un-

wholesome or unfit for the food of man, he may, by written notice to the sanitary authority, specifying such article, and containing a sufficient identification of it, request its removal, and the sanitary authority shall cause it to be removed as if it were trade refuse.

City of London Sewers Act, 1851

The officers authorized to inspect and seize meat are M.O.H.s and S.I.s, but provision is made in the City of London Sewers Act, 1851, for the appointment of " Inspectors of Slaughter-houses and Meat ". These officers have power to enter places used for slaughtering cattle or for the deposit or keeping of meat and to seize cattle, carcasses and meat which appear to them to be unsound, or unwholesome, or unfit for the food of man, for the purpose of having them " inspected or examined by competent persons ". After such inspection and examination, if declared diseased, &c., the animal, carcass, or meat is destroyed. The " Inspectors of Slaughter-houses and Meat " also have power to seize diseased, &c., meat exposed for sale in any part of the City, and to cause the same to be removed and forthwith immediately destroyed. These powers appear to be wider than any contained in a general statute.

Other powers in relation to diseased meat are contained in Sec. 39 of the City of London (Various Powers) Act, 1911, which is as follows:

City of London (Various Powers) Act, 1911

SEC. 39.—(1) Where any animal or article has been seized within the City of London under Sec. 47 of the Public Health (London) Act, 1891, and has been condemned as diseased or unsound or unwholesome or unfit for the food of man any person who sent, consigned or delivered or caused to be sent, consigned or delivered such animal or article for sale or for deposit for the purpose of sale or of preparation for sale shall be liable on summary conviction to a fine not exceeding £50 or at the discretion of the court without the infliction of a fine to imprisonment for a term of not more than six months with or without hard labour, unless he proves that at the time of the commission of such act he did not know and had no reason to believe that such animal or article was in such condition.

(2) Where any offence under this section appears to have been wholly or partially committed or has taken place outside the City of London, the Corporation or their officers may take or cause to be taken against any person in respect of such offence any proceedings in relation to such offence with the same incidence and consequences as if such offence were committed or took place wholly within the City.

London County Council (General Powers) Act, 1908

SEC. 8 applies to any room, shop, or other part of a building within the County of London in which any article whether solid or liquid intended or adapted for the food of man is sold or exposed for sale or deposited for sale or for preparation for sale or with a view to future sale; and specifies the requirements which should apply to any such room. These are very similar to those of Sec. 72 of the P.H. Act, 1925. (See p. 420.)

The Infectious Diseases (London) Regulations, 1927—Part III

The provisions of Part III are identical with those of Part III of the P.H. (Infectious Diseases) Regulations, 1927. (See p. 421.)

Scotland

Public Health (Scotland) Act, 1897

SEC. 43.—(1) Any M.O.H. or S.I., or V.S. authorized by the L.A., may at all reasonable times enter any premises within the district of the L.A., or search any cart or vehicle, or any barrow, basket, sack, bag, or parcel, in order to inspect or examine, and may inspect or examine—(*a*) Any animal, alive or dead, intended for the food of man, which is exposed for sale or deposited in any place, or is in course of transmission for the purpose of sale or of preparation for sale; and (*b*) any article, whether solid or liquid, intended for the food of man, and sold or exposed for sale, or deposited in any place, or in course of transmission for the purpose of sale or of preparation for sale. If any such animal or article appear to be diseased or unsound, or unfit for the food of man, the M.O.H., S.I., or V.S. may seize and carry away the same himself, or by an assistant, in order to have the same dealt with summarily by a sheriff, magistrate, or justice. When dealing with a living animal the M.O.H. or S.I., unless a qualified veterinary surgeon, must be accompanied by a V.S. The onus of proof that the unsound food was not exposed or deposited, or in course of transmission for any such purpose, or was not intended for the food of man rests with the person charged. The police are empowered to search carts, &c., and to assist generally in executing and enforcing this section.

(2) If the sheriff, magistrate, or justice is satisfied that the animal or article which has been seized, or is liable to be seized, is diseased, unsound, or unfit for the food of man, he shall condemn it, and order it to be destroyed, or so disposed of as to prevent it from being exposed for sale or used for the food of man. The owner or person charged is liable to a fine not exceeding £50 for every such animal or article. If the article condemned consists of fruit, vegetable, corn, bread, or flour, he is liable for every parcel thereof so condemned, unless he proves that he and the person acting on his behalf (if any) did not know, and could not with reasonable care have known that it was in such a condition. Where the proceedings are before a sheriff, and the court finds that the offence has been knowingly and wilfully committed, the penalty may be imprisonment for not more than three months, with or without hard labour, and payment of all expenses caused by the seizure, detention or disposal of the unsound food. If a V.S. approved by the L.A. has, within a reasonable time prior to the seizure, examined, passed, and granted a certificate that the animal or part condemned was fit for food, the person charged is exempt from penalty or imprisonment.

(3) A L.A. or combined L.A.s may appoint places and fix times at which an approved V.S. shall attend for the purpose of examining any animal alive or dead, in order to pass or condemn the same. Such V.S. shall, on receipt of a fee paid by the owner, examine and pass or condemn in whole or in part any animal or carcass so submitted to him; and if he shall pass the same he shall grant a certificate of passing which shall set forth the name of the owner, the date and hour of examination, and such particulars regarding the animal or carcass as the L.A. may prescribe. If he condemn it, the L.A. must retain and forthwith destroy the condemned part, or so dispose of it as to prevent it from being exposed for sale or used for the food of man, and the owner shall be entitled to the net price realized from the residual product of the carcass or part so condemned, after deduction of the expenses of condemnation and destruction. No carcass shall be submitted for examination either under this or the immediately preceding subsection, unless as a whole carcass, including the thoracic and abdominal viscera, in such manner that the examiner shall be readily able to satisfy himself that the organs are those of the carcass under inspection.

(4) If the person charged shows that the animal, &c., was purchased by him or consigned to him from another person for the food of man, and when so purchased or consigned was unfit for food, the previous seller or the consignor is liable to be brought to trial and fined in a court in the district where the seizure was made. If he can prove that at the time of sale or consignment he was although exercising reasonable care ignorant of the condition of the animal or article, he is exempt.

(5) A copy of any certificate granted by a V.S. under subsections 2 or 3 shall forthwith be sent by him to the chief constable of the district where the examination of the animal or carcass was made. The person selling the animal or carcass must send the certificate itself forthwith after the sale, and not more than seven days after it was issued, to the chief constable of the district where the sale took place. Contravention of this subsection entails a fine not exceeding £20.

(6) If a person be convicted twice within 12 months of any offence under this section, the sheriff, magistrate, or justice, if he finds that the offence has been wilful on both occasions, may order a notice of the facts to be affixed to the premises occupied by that person, and anyone defacing, concealing, removing, or hindering the affixing thereof is liable to a penalty not exceeding £5.

(7) If a convicted person be the occupier of a licensed slaughter-house the licence may be cancelled.

(8) Obstruction of the M.O.H., S.I., or V.S. in the execution of this section entails a fine, or if it be a second offence within a year, or be done with intent to prevent the discovery of an offence, the offender may be imprisoned for a month.

(9) A sheriff, magistrate, or justice may act in adjudicating on an offender under this section whether he has or has not acted in ordering the animal or article to be destroyed or disposed of.

Public Health (Meat) Regulations (Scotland), 1932

(1) In these Regulations, unless the context otherwise requires:

" Carcass " means the body of an animal excluding the organs and viscera thereof.

" Cattle " or " bovine " includes a bull, cow, ox, heifer, calf, sheep and goat, but not a pig.

" Cold store " means any place used for the purpose of storing or preserving any meat or meat food product intended for sale for human consumption and in which the atmosphere is kept at a low temperature by means of ice, or by any process of refrigeration, or by any other means whatsoever.

" Department " means the Department of Health for Scotland.

" Detention Officer " means any person qualified as after mentioned appointed by a L.A. to act as D.O. in the execution of these Regulations.

" Local Authority " means in relation to a large burgh within the meaning of the Local Government (Scotland) Act, 1929, the T.C., and in relation to a county (including all other burghs therein) the C.C.

" Meat food product " means any article of food intended for sale for human consumption and derived or prepared in whole or in part from the carcass or the organs or viscera of cattle or swine.

" Meat Inspector " means any person qualified as after mentioned appointed by a L.A. to act as M.I. in the execution of these Regulations, and includes any assistant M.I., being a person so qualified, appointed by a L.A. to act in the execution of these Regulations.

" Pig " or " swine " includes boar, sow and hog.

" Private slaughter-house " means any abattoir, shambles or slaughter-house (not being a public abattoir) licensed in terms of Sec. 33 of the P.H. (Scotland) Act, 1897.

"Public abattoir" means any abattoir, shambles or slaughter-house maintained by a C.C. or a T.C. in terms of Sec. 278 of the Burgh Police (Scotland) Act, 1892, or Section 34 of the P.H. (Scotland) Act, 1897, or other statutory enactment.

"Seize" in relation to meat inspected in accordance with these Regulations means seize as diseased, or unsound, or unfit for the food of man, and "seizure" shall be construed accordingly.

"Veterinary Surgeon" means any member of the Royal College of Veterinary Surgeons.

(2) The Interpretation Act, 1889, applies to the interpretation of these Regulations as it applies to the interpretation of an Act of Parliament.

3. The P.H. (Meat) Regulations (Scotland), 1924, shall be revoked, but without prejudice to the effect of any notice, certificate, resolution, advertisement, proceedings or other thing given, issued, begun, or done in pursuance of the said Regulations.

4.—(1) The L.A. shall superintend and see to the execution of these Regulations within the area of the L.A. and shall appoint such officers as are required for the purposes of these Regulations.

(2) Two or more L.A.s may combine for the purposes of these Regulations on such terms as the Department may by Order approve or determine, and these Regulations shall apply to and as respects any such combination subject to such adaptations and modifications as may be specified in the Order.

5.—(1) No person shall be qualified to act as a M.I. under these Regulations unless he is either the M.O.H. of the area, or a V.S., or a person who, not being the M.O.H. or a V.S., has received special training in the work of meat inspection and, prior to the first day of June, 1923, has had not less than seven years' practical experience in that work and has obtained from the Department a certificate (which may at any time be cancelled or withdrawn) that he is qualified to act as a M.I. in the execution of these Regulations.

(2) No person shall be qualified to act as a D.O. under these Regulations unless he has had such experience and training as the M.I. of the area may consider necessary to enable him to recognize any departure from the normal in the carcass, organs, or viscera of an animal.

6.—(1) Every M.I. and every D.O. shall, when inspecting the carcasses, organs and viscera of cattle or pigs intended for sale for human consumption, comply with the provisions of Parts I, II and III of the Instructions set out in the First Schedule hereto; and every person engaged in the work of slaughtering cattle or pigs, or of dressing the carcasses, organs or viscera of such animals shall comply with the provisions of Part I A of the said Instructions so far as the same are applicable to such person or to such work; and every M.I. shall, in determining the action to be taken in the event of any evidence of disease being found in a carcass or in the organs or viscera, comply with the provisions of Parts IV and V of the said Instructions.

(2) Where meat is seized in accordance with the provisions of these Regulations, the provisions of subsections (1) and (2) of Sec. 43 of the P.H. (Scotland) Act, 1897, with respect to seizing and carrying away the meat and having it dealt with by the Sheriff, Magistrate or Justice, shall apply, with the necessary modifications, as if the meat had been seized under the provisions of the said subsection (1) and the officer seizing and carrying away the meat were an officer mentioned in that subsection.

7.—(1) A C.C. or T.C. which maintains a public abattoir shall cause to be kept by the person in charge of the abattoir detailed records of the matters set forth in Part I of the Second Schedule to these Regulations.

(2) Every L.A. shall cause detailed records to be kept by the M.I. and the

D.O. of the matters relating to inspections and seizures in private slaughter-houses set forth in Part II of the Second Schedule to these Regulations.

(3) The records to be kept in terms of this Article shall be in such form as the Department may determine or approve and shall be open to inspection by an officer of the Department appointed for the purpose, and the respective authorities shall when required furnish to the Department copies of said records or such extracts therefrom or such returns or reports with reference thereto as the Department may determine.

8.—(1) A C.C. or T.C. granting a licence under Sec. 33 of the P.H. (Scotland) Act, 1897, for the use of premises as a private slaughter-house, shall specify in such licence the days and hours on and within which cattle or swine may be slaughtered at the slaughter-house to which the licence refers and such Council in fixing the days and hours shall have regard—

(*a*) to the desirability of the days and hours being such as to permit, as far as practicable, of inspection by a M.I. or a D.O. of every slaughter-house within their area during the period fixed for slaughtering thereat; and

(*b*) to the nature and extent of the business carried on at the slaughter-house.

The person having the control and management of the slaughter-house may, within one month of the date of intimation of the determination of such Council appeal to the Department with respect to the days or hours fixed by the Council as aforesaid and the decision of the Department shall be final.

(2) No person shall slaughter or cause to be slaughtered any cattle or swine in any private slaughter-house at any time other than the times specified in the licence except on giving or causing to be given to the Clerk to the L.A. or to the M.I., not less than 24 hours' previous notice in writing, stating the time at which the slaughtering is to take place, and where such notice is given to the Clerk he shall forthwith inform the M.I. or a D.O. with a view to his being present at the time of slaughtering; but the provisions of this paragraph shall not apply to any cattle or swine slaughtered in a private slaughter-house because of any accident or illness that renders immediate slaughter necessary or advisable, and, where any cattle are slaughtered on account of any such accident or illness, the provisions of Article 9 hereof shall apply as if the animal had been slaughtered at a place other than a public abattoir or private slaughter-house.

9.—(1) No bovine intended for sale for human consumption shall be slaughtered in any place other than a public abattoir or private slaughter-house, except on account of accident, illness, or other emergency of such an exceptional nature as to render that course necessary; and where in any such emergency any bovine is slaughtered in any such place, the person ordering or authorizing the slaughter of the animal shall forthwith give notice to the Clerk to the L.A. or the M.I. setting forth particulars of:

(*a*) the time and place at which the slaughtering has taken or is to take place;
(*b*) the animal slaughtered or to be slaughtered; and
(*c*) the reasons for the emergency.

When such notice is given to the Clerk he shall forthwith intimate the same to the M.I.

(2) The M.I. shall, either by himself or by a D.O., inspect within the period of 24 hours mentioned in this paragraph the carcass, organs and viscera of the bovine, and shall deal with the same in every respect (including the keeping of records in accordance with Article 7 hereof) as though it had been slaughtered in a private slaughter-house; and for the purpose of such inspection the lungs, liver

and heart shall not be severed from the carcass until 24 hours after the notice aforesaid has been delivered or received in course of post, or until 24 hours after slaughter, whichever is later, unless the carcass has, prior to the expiration of that period, been inspected and passed by a M.I. or D.O.

(3) Every carcass dealt with under this Article shall be ribbed and quartered before it is released as fit for human consumption.

10. Any person who receives, for purposes of sale for human consumption, the carcass or part of the carcass or any of the organs or viscera of any animal that to his knowledge has been slaughtered elsewhere than in a private slaughter-house or public abattoir shall, unless he knows that it has already been inspected in terms of these Regulations, forthwith notify the Clerk to the L.A. of the area or the M.I., and the M.I., on being so notified or on receiving intimation from the Clerk, shall immediately take steps to have it inspected in accordance with these Regulations.

11.—(1) The body of a dead animal or the carcass, or any of the organs or viscera of an animal, shall not be admitted into a public abattoir or private slaughter-house unless accompanied by—

(*a*) a certificate by a M.I. or D.O. that it has been inspected in accordance with these Regulations and passed by him as fit for human consumption; or

(*b*) a certificate by a V.S. that the animal has not died of any disease notifiable under the provisions of the Diseases of Animals Act, 1894, or any amendments of that Act.

(2) On any moribund animal being admitted into a public abattoir or private slaughter-house, the superintendent or person in charge shall immediately notify the same to the V.S. approved by the L.A. under Sec. 43 of the P.H. (Scotland) Act, 1897, or if there is no such V.S., then to the M.O.H. of the L.A.

12.—(1) Section 281 of the Burgh Police (Scotland) Act, 1892, which requires T.C.s to make bye-laws for slaughter-houses within burghs shall, except with regard to registration, apply with respect to public abattoirs in burghs to which the said Act applies or which have adopted the said Section, whether such abattoirs were provided before or after the passing of that Act, as it applies with respect to other slaughter-houses.

(2) Every C.C. shall make bye-laws under Section 32 (3) of the P.H. (Scotland) Act, 1897, with respect to the conduct of the business of slaughterer of cattle (including swine) or horses whether such business is carried on at a public abattoir or in a private slaughter-house.

13.—(1) Where a L.A. satisfy the Department that they have made suitable arrangements (including the appointment of M.I.s) for the inspection at the time of the slaughter of cattle or swine slaughtered within their area, the Department may, on the application of the L.A., authorize them to use for the purpose and in the manner specified in this Article a distinctive mark of a design approved by the Department and so devised as to indicate the identity of the L.A. and of the M.I. using the mark.

(2) A L.A. whose mark has been approved by the Department may by an instrument in writing signed by their Clerk authorize a M.I. to affix or impress the same to or on any carcass or part of the carcass of an animal slaughtered for the food of man, in any case in which he has inspected the whole carcass with all the organs and viscera at the place of slaughter, and such carcass or part has appeared to him to be free from disease, sound, wholesome, and fit for the food of man, and no mark shall be used otherwise than in accordance with such authorization.

(3) The L.A. and their M.I.s shall comply with any directions given by the Department as to the use of such mark and they shall not cause the mark to be affixed to or impressed on any carcass or part of a carcass except at the request

or with the consent of the person having possession of the carcass at the time of inspection.

(4) The L.A. may charge any sum not exceeding one shilling for each carcass or part of a carcass marked in terms of this Article.

(5) The Department shall have power at any time at their discretion to revoke their authorization of the use of a mark or their approval of a mark adopted as aforesaid.

(6) No L.A. shall use or permit to be used a mark indicating that the carcass or any part of the carcass of an animal for human consumption has been inspected unless such mark has been approved by the Department and such approval has not been revoked.

(7) No person other than a M.I. authorized as aforesaid shall make use of a mark adopted and approved as aforesaid, and no person shall make use of any mark so resembling a mark adopted and approved as aforesaid as to be calculated to deceive.

14. No person shall keep or store in any stable, byre, or other premises in which live animals are kept, or in any room or apartment that is used as a living room or sleeping room or in any premises that are not kept in a clean and sanitary condition, any meat or meat food product intended for sale for human consumption.

15.—(1) Where a L.A., by resolution passed at a duly convened meeting, determine that the provisions of this Article shall apply in their area or any part thereof and such resolution has been advertised at least once in each of three successive weeks in a newspaper circulating in the area or in such part the following provisions shall have effect therein—

(i) No person other than a person keeping open shop for the sale of meat or meat food products shall, by himself or by any person employed by him, sell or offer or expose for sale any meat or meat food product from any cart or other vehicle or from any basket, barrow, booth or stance unless he holds a certificate from the L.A. of the area in which the accommodation used by him for the storage of the meat or meat food products is situate approving such accommodation.

(ii) (*a*) A certificate of approval of storage accommodation shall not be withheld by a L.A. unless they are satisfied that the storage accommodation is, having regard to the interests of public health, unsatisfactory for the purpose of storing meat or meat food products.

(*b*) A certificate of approval shall have effect only as respects the person to whom such certificate has been granted.

(iii) (*a*) Every certificate of approval shall, subject as hereinafter provided, be for a stated period not exceeding one year and such fee not exceeding ten shillings may be charged therefor as the L.A. may determine.

(*b*) The L.A. may at any time during the period for which such certificate of approval is granted withdraw the certificate if they are satisfied that in the interests of public health it should be withdrawn, provided that the L.A. shall first have given the person from whom the certificate is proposed to be withdrawn an opportunity of being heard; and on any such withdrawal, or upon the use of the premises in respect of which the certificate of approval has been granted being discontinued, the certificate shall forthwith be returned to the L.A.

(iv) Any person from whom a certificate of approval has been withheld or withdrawn may, within seven days from the date on which such withholding or withdrawal has been intimated to him, appeal to the Department against such withholding or withdrawal, and the decision of the Department shall be final. Where the Department

decide that such certificate of approval should not have been withheld or shall not be withdrawn, the L.A. shall comply with the decision of the Department. Pending the final determination in any appeal with respect to the withdrawal of a certificate of approval the certificate shall continue to have effect.

(v) The M.O.H., the S.I., or any other officer of the L.A. appointed for the purpose shall have power at all reasonable times to enter and inspect any storage accommodation in respect of which an application has been received for a certificate of approval or in respect of which such a certificate is in operation, and also any premises which he shall have reason to believe are being used as storage accommodation for meat or meat food products intended for sale from a cart or other vehicle or from a basket, barrow, booth or stance.

(vi) A person, in relation to anything within his knowledge, shall truly answer all questions put to him by a L.A. or their officers with a view to ascertaining whether these Regulations are being observed.

(vii) Every person in charge of a cart or other vehicle or of a basket, barrow, booth or stance from which meat or any meat food product is being sold or offered or exposed for sale, shall, on demand, produce to the M.O.H., S.I. or other officer of the L.A. appointed for the purpose or to any officer of police, the certificate of approval of the appropriate storage accommodation or a copy thereof certified by or on behalf of the L.A. granting such certificate, for which copy the L.A. shall be entitled to charge a fee not exceeding one shilling.

(viii) Every L.A. shall keep a register of storage accommodation in respect of which certificates of approval are granted under this Article and of the persons to whom such certificates are granted.

(ix) Where the L.A. of the area in which a person (other than a person keeping open shop for the sale of meat or meat food products) sells or offers or exposes for sale meat or meat food product as aforesaid have adopted this Article, and the L.A. of the area within which the storage accommodation of such person is situated have not adopted this Article, the first mentioned L.A. shall, with reference to the granting, withholding or withdrawal of a certificate of approval exercise all the powers and duties under this Article as if the storage accommodation were within their own area, and for that purpose the second mentioned L.A. shall be bound, on being so required by the first mentioned L.A., to cause the storage accommodation to be inspected by their M.O.H. or S.I. and to furnish the first mentioned L.A. with such reports by the M.O.H. or S.I. with reference to the accommodation as the first mentioned L.A. may require.

(2) Where the provisions of Article 10 of the P.H. (Meat Inspection) Regulations (Scotland), 1923, or Article 12 of the P.H. (Meat) Regulations (Scotland), 1924, have been adopted in respect of their area or any part thereof such adoption shall have effect as if the L.A. had adopted the provisions of this Article in respect of their area or the part thereof to which such adoption refers and any authorization or certificate of approval granted in terms of the said Article 10 or Article 12 shall have effect as if it were a certificate of approval granted in terms of this Article as respects the storage accommodation to which such authorization refers, and for the period for which such authorization had been granted.

16.—(1) Every L.A. shall keep a register of all cold stores within their district, and such register shall be in a form approved by the Department and shall show the situation of each cold store, the names and addresses of the owner or owners and of the person having the charge, management or control thereof, the nature

of the meat or meat food products usually stored therein, and the means by which the atmosphere of the store is kept at a low temperature.

(2) Every person who, at the date on which these Regulations come into operation, has the charge, management or control of any cold store which has not already been registered under either of the Regulations mentioned in Article 15 (2) hereof shall send to the Clerk to the L.A. or to the M.I. an intimation giving the particulars required for the purposes of the register, within fourteen days of that date; and every person who, subsequent to the said date, acquires the charge, management or control of a cold store, shall within fourteen days of such acquisition send to the Clerk to the L.A. or to the M.I. an intimation giving the particulars required as aforesaid, and every person who has the charge, management or control of any registered cold store shall forthwith when the occasion so requires give written intimation to the Clerk to the L.A. or to the M.I. of any change or alteration which may have taken place in or with reference to such cold store so far as the same relates to particulars registered as aforesaid.

17. Any officer appointed by the Department for the purpose shall at all reasonable times be entitled to enter and inspect any public abattoir, private slaughterhouse or cold store and to examine any carcass, organs or viscera, meat or meat food products therein.

18. If any question arises in relation to any subject matter of or to anything done under these Regulations the question may, on the application of all the parties concerned, be referred to the Department for determination.

19. These Regulations shall, save as hereinafter provided, apply with respect to horses, and the carcasses, organs and viscera of horses intended for sale for human consumption in all respects as they apply to cattle and the carcasses, organs and viscera of cattle intended for sale for human consumption: Provided that nothing herein contained shall require the inspection of horses and the carcasses, organs and viscera of horses in regard to which the owner thereof satisfies the L.A. that such carcasses, organs or viscera are intended for exportation outside Great Britain, Northern Ireland, the Channel Islands and the Isle of Man.

SCHEDULES

First Schedule

INSTRUCTIONS WITH REFERENCE TO INSPECTION

Part I.—General Instructions

A

1. The carcass and the organs and viscera of an animal that is free from disease, in the carcass and in the organs and viscera, and that is well nourished, shall be passed.

2. If disease is found in any part of a carcass, or in any organ, or in the viscera, or if there is any appreciable departure from the normal, or if the carcass is emaciated or poorly nourished, the entire carcass, organs and viscera shall be detained for further inspection by the M.I.

3. When a carcass, organs and viscera or any of them have been detained, the D.O. shall immediately notify the M.I.

4. Evidence of disease shall not be modified or obliterated by washing, rub-

bing, stripping, or in any other manner, until the carcass, organs and viscera have been examined by the M.I.

5. In no case other than cases of "back bleeding" shall the serous membranes be stripped except by or under the direction of the M.I. and in any case of back bleeding in which immediate stripping is necessary to preserve the marketability of the carcass, the membranes shall not be entirely detached from the carcass until it has been examined by the M.I.

6. A tuberculous carcass shall not be wiped down with the ordinary wiping cloth. A cloth that has been used for wiping down a tuberculous carcass shall not again be used until it has been boiled for fifteen minutes in water containing soda.

7. Knives that have been used for cutting or incising any diseased organ, gland, or tissue, shall not again be used for any purpose until they have been disinfected in boiling water, or in other suitable disinfectant.

8. When any abnormal condition is observed the nature and significance of which cannot be determined by observation and palpation, the organ and/or gland shall be incised, and the incisions shall be made in such manner as to avoid soiling or contaminating any part of the carcass or other organs or viscera that may be passed as fit for human consumption.

9. The lymph glands shall be examined by multiple incisions into their substance.

B

1. *Organs and Viscera*:

(*a*) All organs and viscera shall be examined as they are removed from the carcass, or in such circumstances as will ensure that they are the organs and viscera of the particular carcass.

(*b*) All organs and viscera, together with the associated lymph glands, shall be examined by observation and palpation.

2. *Carcass*:

(*a*) The carcass shall be examined for (1) condition of nutrition; (2) evidence of bruising, hæmorrhage, or discolouration; (3) local or general dropsy (œdema); (4) the efficiency of bleeding; and (5) swellings or deformities of bones or joints, or swellings or other abnormality in the musculature.

(*b*) The serous membranes (pleura and peritoneum) shall be examined in every case, and in no case shall they be removed nor shall any evidence of disease be modified or obliterated by washing, rubbing, stripping, or in any other manner before examination.

(*c*) Where a carcass is split, the sternum, ribs, vertebræ, and spinal cord shall be examined.

Part II.—Detailed Instructions for Routine Inspection of Carcasses, Organs and Viscera of Bovines and Swine

1. *Head*:

The head, including (*a*) the surface and substance of the tongue (which shall be loosened but not detached before examination), (*b*) the palate or roof of the mouth, and (*c*) the lymph glands of the throat (retro-pharyngeal, submaxillary, and parotid), shall be examined; and the cheek muscles shall be examined by a linear incision parallel to the lower jaw.

2. *Abdominal Cavity*:

(*a*) *Stomach, Intestines, and Spleen.*—The inner and outer surface of the stomach and intestines, and the surface and substance of the spleen shall be

examined, together with the glands of the stomach and bowel (gastro-splenic and mesenteric) and the web (omentum).

(*b*) *Liver.*—The surface and substance of the liver shall be examined—an incision being made into the thick end in the case of cattle. The associated glands (hepatic) shall also be examined and the bile ducts incised.

(*c*) *Kidneys.*—The lymph glands of the kidneys (renal) and the adrenal glands shall be examined before the removal of the kidneys. Thereafter the kidneys shall be removed, and the surface examined, and, if necessary, the kidneys shall be split by incision and the substance examined.

(*d*) *Uterus and Ovaries.*—The inner and outer surface of the uterus, and the substance of the ovaries shall be examined.

3. *Thoracic Cavity*:

The pluck shall be examined in the following manner before the various organs are separated from each other:

(*a*) *Lungs.*—The lungs shall be examined by observation and by palpation, and, unless obviously diseased, they shall be incised at the base. The associated lymph glands (bronchial and mediastinal) shall also be examined, and, unless obviously diseased, shall be incised.

(*b*) *Heart.*—The heart sac (pericardium) shall be opened; and the walls of the heart shall be incised so as to open the ventricles.

4. *Udder*:

The udder shall be examined by observation and by palpation; incisions shall be made at the base of the teats, and the associated glands (supra-mammary) shall also be incised.

5. *Testicles and Penis*:

The outer surface and the substance of the testicles and penis and the superficial inguinal glands shall be examined.

6. *Serous Membranes*:

The lining (serous) membranes of the chest and abdomen (pleura and peritoneum) shall be examined in every case.

The following lymph glands shall be examined as a matter of routine in *all* cases, viz.:

(1) retro-pharyngeal (in bovines) and submaxillary (in swine); (2) bronchial and mediastinal; (3) hepatic; and (4) mesenteric.

Part III.—Additional Instructions as to Method of Inspection for Evidence of Tuberculosis in Bovines and Swine

1. All organs and viscera, and the associated lymph glands, shall be examined for evidence of tuberculosis both in the substance and in the covering membranes (capsules). *The existence of tuberculosis in the lymph gland of an organ shall be held to be evidence of the disease in the organ.*

2. The carcass lymph glands shall be examined in accordance with the following instructions (the glands in every case being exposed before examination, and incised):

(*a*) When visible evidence of tuberculosis is found in a carcass, or in the organs or viscera, those glands which, having regard to such visible evidence, are least likely to be infected shall be examined first, e.g. if

evidence of tuberculosis is found on the pleura, the glands of the hindquarters shall be examined before those of the forequarters.

(*b*) If a tuberculosis lesion or an abscess is found in any carcass lymph gland, all the other carcass lymph glands shall be examined.

(*c*) If evidence of tuberculous disease is found on a serous membrane (pleura or peritoneum) all the carcass lymph glands shall be examined.

(*d*) If the throat glands (retro-pharyngeal, submaxillary, or parotid) are affected with tuberculosis, the cervical, prepectoral and prescapular glands shall be examined.

(*e*) If the bronchial and/or mediastinal glands are affected with tuberculosis, the prepectoral, supra-sternal, prescapular, intercostal, and xiphoid glands shall be examined.

(*f*) If the liver and/or the associated lymph glands (hepatic) are affected with tuberculosis, all the carcass lymph glands shall be examined.

(*g*) If the bowel glands (mesenteric) are affected with tuberculosis, the superficial inguinal (or supra-mammary), the lumbar, renal, iliac and precrural glands shall be examined.

(*h*) If the uterus is affected with tuberculosis, the iliac, precrural, lumbar, and sacral glands shall be examined.

(*i*) If the penis or the testicles are affected with tuberculosis, the superficial inguinal, iliac, sacral, popliteal, and precrural glands shall be examined.

(*j*) If tuberculosis lesions are found in the bones, joints, limbs, or the spinal cord, all the carcass lymph glands shall be examined.

(*k*) If the submaxillary gland in a pig is affected with tuberculosis the carcass shall be split and all the carcass lymph glands shall be examined.

(*l*) The carcass of a pig in which lesions of tuberculosis are found in any situation or in any degree shall be split and the bones of the vertebræ examined and all the carcass lymph glands shall be examined.

Part IV.—Instructions as to Action to be taken in the event of Evidence of Tuberculosis being found in Bovines and Swine

1. An organ shall be seized when tuberculosis exists on its capsule, or in its substance, or in the associated lymph glands.

2. The head, including the tongue, shall be seized:

(*a*) when the retro-pharyngeal, parotid, and submaxillary glands, or any two of these, are affected;

(*b*) when the retro-pharyngeal gland alone in bovines, or the submaxillary gland alone in swine, is affected, unless the lesions are small, inactive, and calcareous, and the gland is not enlarged, in which case the head shall be passed, after removal of the glands, the base of the tongue, and the pharynx with the structures in its immediate neighbourhood.

3. The entire carcass, and all the organs and viscera shall be seized when the following conditions are found:

(*a*) Tuberculosis with emaciation.

(*b*) Generalized tuberculosis.

In determining whether the disease is generalized, the judgment shall be based on the sum of the evidence of disease throughout the entire carcass and organs. The following shall be regarded as evidence of this condition:

(1) Miliary tuberculosis of both lungs, with any evidence of tuberculosis elsewhere.

(2) Where lesions are multiple, acute, and actively progressive.
(3) Where there is multiple and widespread infection of the carcass lymph glands.
(4) Where there are diffuse acute lesions of both serous membranes (pleura and peritoneum) and any of the carcass lymph glands are enlarged or contain visible tuberculosis lesions.
(5) Where, in addition to the presence of tuberculosis lesions in the respiratory and digestive tracts, there are also lesions present in the substance of any two of the following: Spleen, kidney, udder (or uterus or ovary), testicle, brain and spinal cord or their membranes.
(6) Congenital tuberculosis in calves.

4. All cases of tuberculosis not included in the immediately foregoing Instructions shall be regarded and treated as localized lesions, and the parts containing the lesions and contiguous thereto shall be seized.

In the application of this Instruction, in cases of widespread infection that do not fall within the category of generalized tuberculosis as laid down in Part IV, Instruction 3 hereof, the rump or rumps shall be seized only when lesions exist in the popliteal gland, and the shoulder blade or shoulder blades shall be seized when lesions exist in the prescapular or brachial glands.

5. If any portion of a carcass, or any organ or viscera becomes contaminated by tuberculous material, it shall be treated as if it were a case of localized tuberculosis.

Part V.—Instructions as to Action to be taken in the event of Evidence of other Disease being found in Carcasses or in Organs or Viscera of Bovines and Swine.

1. The entire carcass, and all the organs and viscera shall be seized if evidence of any of the following diseases is found—

(1) Actinomycosis, generalized.
(2) Anæmia (if pronounced).
(3) Anthrax. (Cases of this disease must be notified in terms of the Diseases of Animals Act.)
(4) Black leg.
(5) Bruising, general, extensive and severe, with or without gangrene.
(6) Cysticercus cellulosæ (measly pork).

N.B.—In the examination of all pig carcasses, the "leaf seam" (sub-peritoneal fat) shall be raised and the inner surface of the abdominal muscles examined for evidence of cysticercus cellulosæ.

(7) Decomposition.
(8) Dropsy, general.
(9) Emaciation, general pathological.
(10) Fever.
(11) Glanders (or Farcy). (Cases of this disease must be notified in terms of the Diseases of Animals Act.)
(12) Immaturity (i.e. stillborn or unborn carcasses).
(13) Jaundice.
(14) Lymphadentitis, caseous.
(15) Malignant catarrh.
(16) Malignant neoplasms—unless localized, in situation and effect, to one organ.
(17) Mammitis, acute septic or gangrenous.
(18) Melanosis, generalized—or any generalized pigmentation.

(19) Metritis, acute septic.
(20) Odour, associated with disease or otherwise prejudicial to health.
(21) Pericarditis, septic.
(22) Pneumonia, septic or gangrenous.
(23) Pyæmia—including joint-ill, or umbilical pyæmia.
(24) Rickets, with malnutrition.
(25) Sarcocysts—if generalized in the musculature and visible to the naked eye.
(26) Septicæmia, or septic intoxication.
(27) Swine erysipelas, acute.
(28) Swine fever. (Cases of this disease must be notified in terms of the Diseases of Animals Act.)
(29) Tetanus.
(30) Trichinosis.
(31) Tumours, multiple, in musculature.
(32) Uræmia.

2. In the event of evidence of *cysticercus bovis* (beef measles) being found in a carcass and/or in a head, the carcass and/or the head may be passed for human consumption provided that they are placed in cold storage at a temperature not higher than 20° Fahrenheit, for a period of at least three weeks, or, alternatively, they shall be seized.

3. In all cases in which evidence of diseases not enumerated in Instructions 1 and 2 above are found, the organ or portion of the carcass (or organs or portions of the carcass) affected by the disease, and the organs or portions contiguous thereto, shall be seized.

Second Schedule

Part I

Records to be kept with regard to animals slaughtered and carcasses, organs and viscera inspected and seized at public abattoirs:

1. Numbers and kinds of animals slaughtered, i.e. oxen, bulls, cows, heifers, calves, sheep, pigs, horses.
2. Numbers and kinds of animals inspected.
3. Numbers and kinds of entire carcasses seized with all the organs and viscera, and the diseases for which they are seized.
4. Numbers and kinds of carcasses seized partially, and/or of organs and viscera seized, the diseases for which they are seized and the portions, organs or viscera seized.
5. Whether the carcasses, portions, organs and viscera seized are (*a*) destroyed with consent of owners, or (*b*) condemned after proceedings before the Sheriff, Magistrate or Justice.
6. Weight of meat seized.
7. How seized meat is disposed of, i.e. whether by destructor, by treatment with disinfectant, by sale, burial or otherwise.

Part II

Records to be kept of inspections and seizures in private slaughter-houses:

1. Dates on which Meat Inspector or Detention Officer visits each private slaughter-house.
2. Numbers and kinds of animals inspected at each visit, i.e. oxen, bulls, cows, heifers, calves, sheep, pigs, horses.
3. Numbers and kinds of entire carcasses seized with all the organs and viscera, and the diseases for which they are seized.
4. Numbers and kinds of carcasses seized partially, and/or of organs and viscera seized, the diseases for which they are seized and the portions, organs or viscera seized.
5. Whether the carcasses, portions, organs and viscera seized are (*a*) destroyed with consent of owners, or (*b*) condemned after proceedings before the Sheriff, Magistrate or Justice.
6. Weight of meat seized.
7. How seized meat is disposed of, i.e. whether by destructor, by treatment with disinfectants, by sale, burial or otherwise.

N.B.—In stating the disease for which any carcass or portion of carcass, organ, or viscera is seized, regard should be had to the nomenclature in the list of diseases in the First Schedule.

The Public Health (Infectious Diseases) Regulations (Scotland), 1927

Part III.—Enteric Fever and Dysentery

The provisions of Part III are similar to Part III of the P.H. (Infectious Diseases) Regulations, 1927 (see p. 42).

Note.—By Article 16 of the Regulations the provisions of Sec. 164 of the P.H. (Scotland) Act, 1897 (which relates to compensation for damages sustained by reason of the exercise of the powers of the Act), are made applicable to any person who sustains any damage by reason of the exercise of any of the powers of these Regulations in relation to any matter as to which he is not himself in default.

Great Britain

Sale of Horse-flesh, &c., Regulation Act, 1889

Sec. 1.—No person shall sell, offer, expose, or keep for sale any horse-flesh for human food, elsewhere than in a shop, stall, or place over or upon which there shall be at all times painted, posted, or placed in legible characters of not less than four inches in length, and in a conspicuous position, and so as to be visible throughout the whole time, whether by night or day, during which such horse-flesh is being offered or exposed for sale, words indicating that horse-flesh is sold there.

Sec. 2.—No person shall supply horse-flesh for human food to any purchaser who has asked to be supplied with some meat other than horse-flesh, or with some compound article of food which is not ordinarily made of horse-flesh.

Sec. 3 empowers any M.O.H., S.I., or other officer appointed for the purpose to examine any meat which he has reason to believe to be horse-flesh, exposed for sale or deposited for the purpose of sale or of preparation for sale and intended for human food, in any place other than such shop, stall, or place as aforesaid,

and if such meat appears to be horse-flesh, to seize and carry it before a justice to be dealt with.

SEC. 4.—On complaint made on oath by any of the above-mentioned officers, a justice may grant a warrant to any such officer to enter any building other than a shop, stall, or place as aforesaid, in which such officer has reason for believing that there is kept or concealed any horse-flesh which is intended for sale or for preparation for sale for human food, contrary to the provisions of the Act, and to seize any such flesh and carry it before a magistrate, in order that it may be dealt with.

SEC. 6 empowers a justice to deal with such horse-flesh as he thinks fit.

The penalty for contravening this Act is a maximum of £20 for each offence. If horse-flesh is proved to have been exposed for sale to the public other than in a shop, stall, or place as aforesaid, without indication that it was not intended for sale for human food, the onus of proving that it was not so intended rests upon the person exposing it for sale.

SEC. 7.—"Horse-flesh" includes the flesh of asses and mules, and means horse-flesh cooked or uncooked, alone or accompanied by or mixed with any other substance.

CHAPTER II

Slaughtering and Slaughter-houses

ENGLAND AND WALES (including London): Public Health Meat Regulations, 1924, Part II—Slaughter of Animals Act, 1933.

ENGLAND AND WALES (excluding London): Public Health Act, 1875, Secs. 4, 169, and 170—Towns Improvement Clauses Act, 1847, Secs. 125–131—Public Health Acts Amendment Act, 1890, Secs. 29–31—Rural District Councils (Slaughter-houses) Order, 1924.

LONDON: City of London Sewers Act, 1851, Secs. 18–23—Public Health (London) Act, 1891, Secs. 19 and 20—London County Council (General Powers) Act, 1903, Sec. 55—Transfer of Powers (London) Order, 1933, &c.

SCOTLAND: Public Health (Scotland) Act, 1897, Secs. 32–34 and 36—Burgh Police (Scotland) Act, 1892, Secs 278, 280, 281, 282, and 284—Slaughter of Animals (Scotland) Act, 1928.

Model Bye-laws

England and Wales (including London)

Public Health (Meat) Regulations, 1924

Part II of the above Regulations contain important provisions relating slaughtering and slaughter-houses (see p. 414).

Slaughter of Animals Act, 1933

PROVISIONS AS TO SLAUGHTER OF CERTAIN ANIMALS IN SLAUGHTER-HOUSES AND KNACKERS' YARDS

1.—(1) No animal to which this section applies shall be slaughtered in slaughter-house or knacker's yard except in accordance with the following provisions, that is to say, every such animal shall be instantaneously slaughtered, o shall by stunning be instantaneously rendered insensible to pain until death supervenes, and such slaughtering or stunning shall be effected by means of a mechanically-operated instrument in proper repair:

Provided that no person shall be liable for any contravention of the provisions of this subsection in respect of:

(*a*) the slaughter of any pig, boar, hog, or sow in a slaughter-house or knacker's yard in which there is not available a supply of electrical energy unless it is proved that such a supply could reasonably have been made available; or

(*b*) the slaughter of any animal slaughtered without the infliction of unnecessary suffering—

(i) by the Jewish method for the food of Jews and by a Jew duly licensed for the purpose by the Rabbinical Commission constituted in accordance with the provisions of the First Schedule to this Act; or

(ii) by the Mohammedan method for the food of Mohammedans and by a Mohammedan.

(2) This section shall not apply within the area of any L.A. to any animal which in that area is exempt from the application thereof under the section of this Act next following, but save as aforesaid this section applies to all animals.

Application of Last Foregoing Section

2.—(1) Every L.A. shall within twelve months after the passing of this Act consider the question whether they will pass a resolution applying the last foregoing section to all or any of the following animals, that is to say, sheep, ewes, wethers, rams and lambs; and if such a resolution is at any time (whether within the said twelve months or thereafter) passed by a L.A. relating to any such animals the last foregoing section shall in their area apply to those animals accordingly, but in any area in which no such resolution is in force the said animals shall be exempt from the application of the last foregoing section.

(2) If at any time a resolution is passed by a L.A. exempting either goats or kids or both such animals from the application of the last foregoing section in their area, the animals to which the resolution relates shall while the resolution is in force accordingly be exempt in that area from the application of the last foregoing section.

(3) The following provisions shall have effect with respect to any such resolution as is mentioned in the foregoing provisions of this section—

(*a*) not less than twenty-eight days before the meeting of the L.A. at which the resolution is to be proposed special notice of the meeting and of the intention to propose the resolution shall be given to every member of the L.A., and the like notice shall also be inserted at least once in one or more of the newspapers circulated within the area of the authority;

(*b*) a resolution, after being passed, shall be published by advertisement in one or more of the newspapers circulated within the area of the L.A. by whom it was passed, and may also be published otherwise in such manner as the L.A. think sufficient for giving notice thereof to all persons interested;

(*c*) a copy of every such resolution passed by a L.A. shall be sent to the M. of H.;

(*d*) any such resolution passed by a L.A. may be rescinded or varied by a subsequent resolution, but the foregoing provisions of this subsection shall apply with respect to any such subsequent resolution.

(4) The following provisions shall have effect with respect to any alteration of the areas of L.A.s, that is to say:

(*a*) any resolution in force under this section in the altered areas shall—

(i) as respects any areas reduced, continue in force until rescinded or varied by the L.A.;

(ii) as respects any areas extended, apply for a period of three months after the extension (unless rescinded within that period) to the whole of the area extended and shall then be deemed to be rescinded as respects the whole area unless in the meanwhile a new resolution has been passed by the L.A.;

(*b*) if at any time a L.A. is newly constituted or the area of any L.A. is extended, the L.A. shall consider the question specified in subsection (1) of this section within three months after the constitution of the authority or after the extension, as the case may be.

Prohibition of Slaughter and Stunning except by Licensed Slaughter-men

3.—(1) No animal shall be slaughtered or stunned in a slaughter-house or knacker's yard by any person who is not the holder of a licence granted by a L.A. and in force under this section:

Provided that this subsection shall not apply with respect to the slaughter of any animal under the Diseases of Animals Acts, 1894 to 1927, by an officer of or person employed by the M. of A. and F.

(2) No licence shall be granted under this section except to a person of the age of eighteen years or upwards who is, in the opinion of the L.A., a fit and proper person to hold such a licence.

(3) A licence under this section shall be in force for such period not exceeding three years as may be specified therein and may be renewed from time to time at the discretion of the L.A.

(4) A licence shall be in force in the district of the L.A. granting the licence and also in the district of any other L.A., and the licence shall be produced on demand for inspection by such other L.A.

(5) The L.A. may suspend the operation of a licence within their area at any time for such period as they may determine and, where they are satisfied that the person is no longer a fit and proper person to hold a licence, the L.A. by whom the licence was granted may revoke the licence.

(6) Any person aggrieved by the refusal of the L.A. to grant or renew a licence or by the suspension or revocation by the L.A. of a licence may appeal to a court of summary jurisdiction against such refusal, suspension, or revocation, within one month of the intimation thereof, and the decision of the court of summary jurisdiction shall be final.

(7) A fee, not exceeding two shillings, may be charged by the L.A. for each such licence, and a fee, not exceeding one shilling, for every renewal thereof.

(8) The provisions of this section shall apply to any licence granted by the L.A. for the purpose of the provisions of this Act with regard to the Jewish and Mohammedan methods of slaughter.

(9) Any person applying for a licence shall in such application state—

(*a*) whether he holds a licence granted under this Act in any area or areas other than that to which his application relates and the names of any such areas;

(*b*) whether he has been refused a licence or has had a licence suspended or revoked in any other area and, if so, the name of that area; and

(*c*) whether he has any similar application pending in any other area and, if so, the name of that area.

Provisions as to Slaughter-houses and Knackers' Yards

4. The provisions set out in the Second Schedule to this Act shall apply to all slaughter-houses and knackers' yards.

Penalties

5. If any person slaughters or stuns, or attempts to slaughter or stun, an animal in a slaughter-house or knacker's yard in contravention of the provisions of Sec. 1 or of subsection (1) of Sec. 3 of this Act, or knowingly makes any false statement for the purpose of obtaining a licence under this Act, or contravenes or causes or permits any contravention of the provisions set out in the Second Schedule to this Act, he shall be liable on summary conviction to a fine not exceeding £10, or on a second conviction to a fine not exceeding £20, or on a conviction subsequent to a second conviction to imprisonment for a period not exceeding three months or to a fine not exceeding £20, or to both such imprisonment and fine:

Provided that a person shall not be liable for any such contravention as aforesaid if he proves that by reason of an accident or other emergency the contravention was necessary for preventing physical injury or suffering to any person or animal.

Employment of Slaughter-men by Local Authority

6. Any L.A. who have provided or established a slaughter-house may, if they think fit, employ persons to slaughter or stun animals, in accordance with the provisions of this Act, and may make such charges as they consider reasonable for the services of the persons so employed.

Inspection of Slaughter-houses and Knackers' Yards

7.—(1) Any M.O.H. or any S.I. duly appointed by a L.A. in whose area the slaughter-house or knacker's yard is situated may enter any slaughter-house or knacker's yard in the district of the L.A. at any time when business is, or appears to be in progress, or is usually carried on therein for the purpose of ascertaining whether there is or has been any contravention of the provisions of this Act, and if any person shall refuse to permit any M.O.H. or S.I. to enter any premises which he is entitled to enter under this Act, or shall obstruct or impede him in the exercise of his duties under this Act, he shall be liable on summary conviction to a fine not exceeding £5.

(2) This section shall not apply with respect to any slaughter-house or knacker's yard which for the time being is or is comprised in an infected place within the meaning of the Diseases of Animals Acts, 1894 to 1927.

Enforcement

8.—(1) The L.A. for the purpose of enforcing the provisions of this Act shall, as regards the Metropolitan Cattle Market in the metropolitan borough of Islington and as regards the City of London, be the common council of the City of London, and as regards their respective areas, the councils of the metropolitan boroughs and county boroughs, and boroughs and urban and rural district councils, and it shall be the duty of every such L.A. to enforce the provisions of this Act within their area. The expenses of enforcing this Act shall be defrayed in the case of the common council of the City of London and metropolitan borough councils, out of the general rate, and in the case of other councils, as expenses incurred in the administration of the P.H.A.s, 1875 to 1926.

INTERPRETATION

9. In this Act the following expressions have the meanings hereby respectively assigned to them, that is to say:

"Animal" means any horse, mare, gelding, pony, foal, colt, filly, stallion, ass, donkey, mule, bull, cow, bullock, heifer, calf, steer, ox, sheep, ewe, wether, ram, lamb, pig, boar, hog, sow, goat or kid.

"Contravention", in relation to any provision of this Act, includes a failure to comply with that provision.

"Knacker's yard" means any building, premises or place used in connexion with the business of killing animals not killed for butcher's meat.

"Local Authority" means a council having under this Act the duty of enforcing the provisions thereof.

"Mechanically operated instrument" includes an instrument for stunning by means of electricity.

"Slaughter-house" means any building, premises or place used in connexion with the business of killing animals for butcher's meat.

FIRST SCHEDULE

This relates to the setting up of the Rabbinical Commission for the licensing of Shochetim (Jewish ritual slaughterers) and specifies the constitution of the Commission.

SECOND SCHEDULE

PROVISIONS AS TO SLAUGHTER-HOUSES AND KNACKERS' YARDS

1. Every person engaged in driving or bringing any animal to the place of slaughter shall—

(*a*) avoid, so far as practicable, driving or bringing the animal over any ground which is likely to cause the animal to slip or fall; and

(*b*) otherwise adopt such methods and precautions as will prevent the infliction upon the animal of unnecessary suffering and pain.

2. Every occupier of a slaughter-house or knacker's yard shall cause every animal brought to such slaughter-house or knacker's yard for the purpose of being slaughtered to be provided with a sufficient quantity of wholesome water, and when it is necessary to confine any such animal for a period exceeeding twenty-four hours with a sufficient quantity of wholesome food.

3. Every occupier of a slaughter-house or knacker's yard and every servant of such occupier and every other person employed upon the premises in the slaughtering of cattle, shall, before proceeding to stun any horse, mare, gelding, pony, foal, colt, filly, stallion, ass, donkey, mule, bull, ox, bullock, cow, heifer, or steer, cause the head of such animal to be securely fastened in such a position as to enable such animal to be felled with as little pain or suffering as practicable, and shall in the process of slaughtering any animal use such instruments and appliances and adopt such method of slaughter, and otherwise take such precautions as may be requisite to secure the infliction of as little pain and suffering as possible.

4. A person shall not so far as is practicable without structural alteration to premises existing at the passing of this Act, slaughter, or cause or suffer to be slaughtered, any animal in the view of another animal.

5. A person shall not use any instrument for slaughtering or stunning any animal unless his ability and physical condition qualify him to use it without inflicting unnecessary pain on the animal, nor shall he use a mechanically-operated instrument in such manner or in such circumstances or in such a state of want of repair as to incur the risk of causing unnecessary suffering to an animal.

6. An occupier of a slaughter-house or knacker's yard shall not (so far as it is reasonably practicable to avoid it) cause or allow any blood or other refuse to flow from such slaughter-house or knacker's yard so as to be within the sight or within the smell of any animal in the slaughter-house or knacker's yard, and he shall not cause or allow any such blood or other refuse to be deposited in the waiting pens or lairs so far as it is reasonably practicable to avoid it.

England and Wales (excluding London)

Public Health Act, 1875
Towns Improvement Clauses Act, 1847

In Sec. 4 of the P.H. Act, 1875, the expression "slaughter-house" is defined to include the buildings and places commonly called slaughter-houses and knackers' yards, and any building or place used for slaughtering cattle, horses, or animals of any description for sale.

Secs. 169 and 170 of the P.H. Act, 1875, and Secs. 125–131 of the Towns Improvement Clauses Act, 1847 (which are incorporated with Sec. 169 of the Act of 1875), give power to S.A.s to provide public slaughter-houses and to regulate private slaughter-houses. The effect of these provisions is as follows:

1. All slaughter-houses and knackers' yards in use at the time of the passing of the special Act (namely, at the time the slaughter-house provisions of the Act of 1847 were applied to the district [1]) must be registered by the owner or occupier with the S.A.

2. All slaughter-houses and knackers' yards used for the first time or erected after the passing of the special Act must be licensed by the urban S.A. (Sec. 126 of the Act of 1847). In the absence of the powers contained in Sec. 29 of the P.H. Acts (Amendment) Act, 1890, licences are not limited in duration by the L.A.

3. The owner or occupier is required to affix and keep undefaced and legible on some conspicuous place on the premises a notice with the words "Registered Slaughter-house" or "Licensed Slaughter-house" as the case may require. (Sec. 170, P.H.A., 1875.)

4. The S.A. must make bye-laws for the licensing and registering, &c., of slaughter-houses and knackers' yards, for keeping the same in a cleanly and proper state, and for removing filth at least once in every twenty-four hours and requiring them to be provided with a sufficient supply of water. (Sec. 128 of the Act of 1847.)

5. Any person convicted of killing or dressing cattle contrary to the provisions of the Act or bye-laws may have his licence suspended for two months by a justice, or, if he is the owner of registered premises, he may be forbidden to slaughter cattle therein for a period not exceeding two months. For a further offence, the licence may be revoked, or, if the slaughter-house is registered, slaughtering therein may be absolutely forbidden.

[1] The slaughter-house provisions of the Act of 1847 were incorporated with Sec. 45 of the P.H. Act, 1858, and Sec. 169 of the P.H. Act, 1875, is a re-enactment of that section. The time of passing of the special Act therefore refers to the passing of the Act of 1858, or such later date as that Act was adopted or the borough or urban district constituted or (in the case of a rural district), the date of operation of an Order of the L.G.B. or M. of H. putting the provisions of Sec. 169 of the Act of 1875 in force in the rural district.

6. Any urban S.A. may provide slaughter-houses, and, if they do so, they must make bye-laws with respect to the management and charges for the use of any slaughter-house so provided.[1]

Public Health Acts Amendment Act, 1890 (Adoptive)

SEC. 29.—Licences for the use and occupation of slaughter-houses granted after this part of this Act is adopted remain in force for a year, or longer, as the urban S.A. shall specify in such licences.

SEC. 30.—Any change of occupation of a registered or licensed slaughter-house must be notified to the S.I. A person who fails to give such notice within a month is liable to a penalty not exceeding £5. Notice of this requirement shall be endorsed on all licences granted after the adoption of this part of this Act.

SEC. 31.—A licence granted under Sec. 29 may be revoked by a court of summary jurisdiction if the occupier of any licensed slaughter-house is convicted of selling or exposing for sale, or for having in his possession, or on his premises, meat which is diseased, or unsound, or unwholesome, or unfit for the use of man as food.

Rural District Councils (Slaughter-houses) Order, 1924

While the above-mentioned provisions of the Acts of 1847, 1875, and 1890 refer in terms to urban S.A.s, they are now in force in all rural districts. In some rural districts they were applied by special order of the L.G.B. or M. of H., and in the remaining rural districts they were applied by the Rural District Councils (Slaughter-houses) Order, 1924.

REGISTERED AND LICENSED SLAUGHTER-HOUSES

The general effect of the foregoing provisions is that all private slaughter-houses must either be registered with, or licensed by, the S.A. While registered slaughter-houses continue to be used as such they are exempt from the necessity of a licence from the S.A. It may be noted that although Sec. 126 of the Act of 1847 does not prescribe the considerations which are to be observed by the S.A. in the granting or refusal of licences,[2] the enactment gives the S.A. discretionary powers, and they may refuse a licence if they are satisfied that the premises are not reasonably suitable for the slaughter of animals. On the other hand, in the registration of premises as slaughter-houses, the S.A. have no power to refuse registration on the ground of the unsuitability of the premises for the purpose.

In the case of terminable licences granted when Sec. 29 of the Act of 1890 was in force in the district, application for the renewal of the licence affords the S.A. opportunity for reviewing the circumstances of the establishment, but in the case of licences granted without limit of time such an opportunity occurs only on the death of the licensee. All slaughter-houses are, however, subject to the general law with regard to nuisances, to the provisions of Part II of the P.H. (Meat) Regulations, 1924, and to any bye-laws made by the S.A. under Sec. 128 of the Act of 1847.

[1] The power of providing a public slaughter-house may also have been obtained by means of a local Act, and where the provisions of Section 17 of the Markets and Fairs Clauses Act, 1847, have been incorporated with any such local Act, that Section would authorize the L.A. to provide a public slaughter-house. A public slaughter-house may also be provided by a county council or the council of a large borough under Section 32 of the Diseases of Animals Act, 1894.

[2] Some recommendations as to the considerations which should be borne in mind by L.A.s in dealing with applications for slaughter-house licences are contained in the prefatory memorandum to the Model Slaughter-house Bye-laws issued by the M. of H. (see p. 449).

The refusal of a S.A. to grant a slaughter-house licence is subject to appeal to a court of quarter sessions, under Sec. 7 of the Act of 1890.

To summarize it may be stated that there are three kinds of private slaughter-houses:

1. Registered—those in use prior to P.H. Act, 1875.
2. Licensed without limit of time—those erected or put into use after the P.H. Act, 1875.
3. Licensed for limited periods not less than a year—those erected in any urban district after adoption of appropriate sections of P.H.A.A. Act, 1890.

Closure of Private Slaughter-houses

There is no power to close a registered or licensed slaughter-house unless—

(*a*) Repeated contraventions of the above-mentioned Acts or bye-laws have been proved before a justice.

(*b*) The slaughter-house has been licensed for a limited period, or there is a change of occupation of a licensed slaughter-house.

(*c*) The S.A. provide a municipal abattoir and apply to the M. of H. for a provisional order empowering them to close private slaughter-houses on payment of compensation.

Public Slaughter-houses

As regards public slaughter-houses, it may be observed that there is no power in the general law enabling a L.A. to prohibit slaughtering in their district elsewhere than in a public slaughter-house provided by them. Such a power has, however, been obtained by some L.A.s under local Acts.

STATUTORY PROVISIONS APPLYING TO LONDON

The control of slaughter-houses and slaughtering in the Metropolis is shared between the L.C.C., the Corporation of the City of London, and the Metropolitan Borough Councils. The statutory provisions under which these authorities act are contained in the City of London Sewers Act, 1851, the P.H. (London) Act, 1891, the London Government Act, 1899, the L.C.C. (General Powers) Act, 1903, the P.H. (Meat) Regulations, 1924, and the Transfer of Powers (London) Order, 1933 (made under Sec. 64 (1) of the Local Government Act, 1929).

In the City of London the Common Council is the authority granting slaughter-house licences, under Secs. 18–23 of the City of London Sewers Act, 1851.

Sec. 20 of the P.H. (London) Act, 1891, deals with the licensing of slaughter-houses in the Metropolis (outside the City of London). All persons carrying on the business of a slaughterer of cattle are required to take out a licence which has to be renewed annually.

Sec. 53 of the L.C.C. (General Powers) Act, 1903, provides that no person shall use any yard, building, or premises for receiving or keeping horses for slaughter or the carcasses of dead horses unless he holds a licence for that purpose. This section does not apply to the City of London.

Under the Transfer of Powers (London) Order, 1933, which came into operation on the 9th March, 1933, the functions of the London County Council in regard to the issue of licences under Sec. 20 of the Act of 1891 and Sec. 53 of the Act of 1903 were transferred to the several Metropolitan Borough Councils.

The regulation of licensed slaughter-houses in London (outside the City) is vested in the L.C.C., who have power to make bye-laws under Sec. 19 (4) of the P.H. (London) Act, 1891, for regulating the conduct of the business of a slaughterer

of cattle and the structure of the premises in which the business is carried on. By Sec. 19 (10) the Commissioners of Sewers (now the Common Council) are the authority for making bye-laws in the City of London, and they have identical powers with the L.C.C. The main difference between the law in London and the provinces is that in the case of districts outside London bye-laws made under the P.H. Act, 1875, cannot deal with the structure of the premises.

The enforcement of the bye-laws regulating slaughter-houses in London rests with the Common Council (in the City of London) and the Metropolitan Borough Councils outside the City. This duty was expressly placed on the borough councils by Sec. 6 (4) of the London Government Act, 1899.

The position of the Corporation of London is a very special one in regard to slaughter-houses and cattle and meat markets. The Metropolitan Cattle Market, with its attached slaughter-houses at Islington, although situated outside the boundaries of the City, is subject to the control of the Corporation of London. By Sec. 19 (9) of the P.H. (London) Act, 1891, the Metropolitan Cattle Market and the slaughter-houses thereat are exempt from the operation of the bye-laws as to slaughter-houses, made by the L.C.C., and by Sec. 20 (8) from the necessity of a licence.

The Smithfield Meat Market in the City of London is under the control of the Markets Committee of the Corporation, and is the wholesale meat market for London and the surrounding districts.

Scotland

Public Health (Scotland) Act, 1897

Sec. 32.—The business of a slaughterer of cattle and horses is an offensive trade in Scotland, and may not be established without the sanction by order of the L.A. and bye-laws may be made for its regulation.

Sec. 33.—A slaughterer of cattle or horses shall not use any premises as a slaughter-house or knackers' yard without a licence from the L.A. Not less than twenty-one days before a licence is granted, notice of intention to apply for it must be advertised, and any interested person may show cause why it should not be granted or renewed. All licences expire on a fixed day annually, with the exception of the first, which remains in operation for the balance of the year and the complete year ensuing. The L.A. have the right to enter any slaughter-house or knacker's yard by day, or when business is in progress or is usually carried on therein, for the purpose of examining whether there is contravention of the provision of the Act or of any bye-law made thereunder. A refusal by a L.A. to renew a licence is subject to appeal to the D. of H. (Scotland), but in the case of a district other than a burgh, an appeal to the Department shall only arise after the C.C. have determined the matter, and a L.A. may appeal to the Department against the determination of the C.C.

Sec. 34.—The L.A. of any district other than a burgh may establish and maintain a public slaughter-house, and such L.A.s may combine for the purpose.

Sec. 36.—As the business of a slaughterer of cattle or horses is in Scotland an offensive trade, a L.A. may, if the business is duly certified or represented to be a nuisance, take action with regard to it as an offensive trade whether it is within or without their district.

Note.—" Slaughterer of cattle or horses " is defined as meaning " a person whose business it is to kill any description of cattle or horses, asses or mules, for the purpose of the flesh being used as butcher's meat ".

Burgh Police (Scotland) Act, 1892

SEC. 278.—T.C.s may establish and maintain slaughter-houses.

SEC. 280.—The M.O.H. shall report to the T.C. at least twice a year on the sanitary condition of slaughter-houses, and he and the S.I. shall have right of access to slaughter-houses at all reasonable times for the purposes of inspection.

SEC. 281.—T.C.s shall make bye-laws for the regulation of slaughter-houses.

SEC. 282 empowers a magistrate to suspend a slaughter-house licence where the holder is convicted of killing or dressing cattle contrary to the Act or bye-laws, and to revoke the licence for a subsequent offence.

SEC. 284.—If a slaughter-house has been provided by the T.C., no person may slaughter any cattle or beasts, or scald or dress the carcasses of any slaughtered cattle, within the boundaries of the Burgh elsewhere than within the T.C.'s slaughter-house. An exception is made in the case of an owner or occupier keeping cattle or beasts within the Burgh who may kill the same for his own or family consumption. To prevent evasion of the use of the slaughter-house provided by the T.C. charges may be levied on persons bringing for sale, within the Burgh the carcasses of animals killed within two miles of the Burgh, and restrictions are also placed on the erection of slaughter-houses in the vicinity of the Burgh.

Slaughter of Animals (Scotland) Act, 1928

The following are the more important provisions of the Act:

1. Every animal, except swine, slaughtered in a slaughter-house or knacker's yard, shall be instantaneously slaughtered, or shall, by stunning, be instantaneously rendered insensible to pain until death supervenes, and such slaughtering or stunning shall be effected by a person (who is at the time the holder of a licence issued by the L.A. under Sec. 2 of the Act) by means of a mechanically-operated instrument in proper repair and of a type approved by the L.A. Any person who contravenes this section is liable on conviction by a court of summary jurisdiction to a fine not exceeding £10, or, on a second conviction, £20, or, on a subsequent conviction, to 60 days' imprisonment, or to a fine of £20 or both.
2. Licences shall only be granted to male persons of eighteen years or upwards who are, in the opinion of the L.A., fit and proper persons to hold such licences. They are valid only in the district of the L.A. granting them and for a period not exceeding twelve months, but may be renewed at the discretion of the L.A. Licences may be suspended or revoked by the L.A. Refusal to grant a licence or suspension or revocation of a licence is subject to appeal to the sheriff.
3. If a L.A. has provided a slaughter-house, they may employ persons to slaughter or stun animals in accordance with the provisions of this Act, and may make charges for the services of the persons so employed.
4. Power of entry to slaughter-houses and knackers' yards is given to any constable and any person authorized in writing by the L.A. to ascertain whether there has been contravention of, or non-compliance with, the provisions of the Act.

The provisions contained in (1) above shall not apply:

(*a*) Where an animal is slaughtered for the food of Jews by a Jew duly licensed for the purpose by the chief Rabbi, and holding a licence granted by the L.A., or for the food of Mohammedans by a Mohammedan holding a licence granted by the L.A., if such slaughtering is carried out according to the Jewish or Mohammedan method of slaughter, as the case may be, and no unnecessary suffering is inflicted.

(*b*) To the slaughter of an animal under the Diseases of Animals Act, 1894 to 1927, if it is carried out by an officer of, or person employed by the M. of A. and F. by means of a mechanically-operated instrument in proper repair, and of a type approved by the Minister.

BYE-LAWS

Power to make bye-laws in respect of slaughter-houses is given in England and Wales by Sec. 169 of the P.H. Act, 1875 (incorporating Sec. 128 of the Act of 1847); in London by Sec. 19 of P.H. (London) Act, 1891; and in Scotland by Sec. 32 of the P.H. (Scotland) Act, 1897, Sec. 281 of the Burgh Police (Scotland) Act, 1892, and Sec. 9 of the Slaughter of Animals (Scotland) Act, 1928.

English Model Bye-laws

Extracts from the M. of H. Memorandum.[1]

It will be seen that the provisions of the Towns Improvement Clauses Act, 1847, incorporated with the P.H. Act, 1875, by Sec. 169 of the latter Act, recognize two classes of slaughter-houses, viz. slaughter-houses in use and occupation at the time of the passing of the "special Act", and slaughter-houses not in use and occupation at that time. To the former class the requirements as to registration in Sec. 127 are specially applicable. To the latter class the provisions as to licensing in Secs. 125 and 126 have direct reference.

Both classes may apparently be regulated by bye-laws under Sec. 128.

In framing a model series of bye-laws, under that enactment, the Board[2] have considered that the statutory terms do not warrant the extension of the scope of the bye-laws to regulations directly affecting the structure of the premises.

But as regards premises for which under Sec. 126 the licence of the Council will be required, the Board have been advised that, in the exercise of the discretionary power of licensing which has been conferred upon the Council, the following rules as to site and structure should influence their decision upon each application for a licence:

1. The premises to be erected or to be used and occupied as a slaughter-house should not be within 100 feet of any dwelling-house; and the site should be such as to admit of free ventilation by direct communication with the external air on two sides at least of the slaughter-house.

2. Lairs for cattle in connexion with the slaughter-house should not be within 100 feet of a dwelling-house.

3. The slaughter-house should not in any part be below the surface of the adjoining ground.

4. The approach to the slaughter-house should not be on an incline of more than one in four, and should not be through any dwelling-house or shop.

5. No room or loft should be constructed over the slaughter-house.

6. The slaughter-house should be provided with an adequate tank or other proper receptacle for water, so placed that the bottom shall not be less than six feet above the level of the floor of the slaughter-house.

7. The slaughter-house should be provided with means of thorough ventilation.

8. The slaughter-house should be well paved with asphalt or concrete, and laid with proper slope and channel towards a gully, which should be properly trapped and covered with a grating the bars of which should be not more than three-eighths of an inch apart.

Provision for the effectual drainage of the slaughter-house should also be made.

9. The surface of the walls in the interior of the slaughter-house should be covered with hard, smooth, impervious material, to a sufficient height.

[1] In the 1933 edition of this Memorandum, clauses 7 to 12 inclusive of the Memoranda previously issued on this subject are omitted. These clauses, which had reference to the inspection of slaughter-houses and the prevention of cruelty therein, are no longer required having regard to the provisions of the Slaughter of Animals Act, 1933.

[2] The expression "Board" in this Memorandum relates to the Local Government Board, now the Ministry of Health.

10. No water-closet, earth-closet, privy, or cesspool should be constructed within the slaughter-house.

There should be no direct communication between the slaughter-house and any stable, water-closet, earth-closet, privy, or cesspool.

11. Every lair for cattle in connexion with the slaughter-house should be properly paved, drained, and ventilated.

12. No habitable room should be constructed over any lair.

It remains to call attention to two provisions contained in the P.H. Acts Amendment Act, 1890, which apply in cases where Part III of that Act has been adopted by an Urban District Council:

(*a*) Under Sec. 29 the U.A. may limit the durations of licences granted, after the adoption of Part III, for the use and occupation of places as slaughter-houses so that such licences " shall be in force for such time or times only, not being less than twelve months, as the Council shall think fit to specify in such licences ". Certain forms which are prescribed by the model clauses will be found to give effect to this provision.

(*b*) Where a licence for the use and occupation of a slaughter-house is granted, after the adoption of Part III, the provisions of Sec. 30 of that Act are required by subsection (3) of that section to be endorsed on the licence. This enactment prescribes that upon any change of occupation of any building within an urban district registered or licensed for use and used as a slaughter-house, the person thereupon becoming the occupier or joint occupier shall give notice in writing of the change of occupation to the S.I. A person failing or neglecting to give the notice becomes liable to a penalty. (Sec. 30 (2).)

The statutory provisions above referred to may be put in force in a rural district or part thereof by an order of the Board (now the M. of H.) under Sec. 276 of the P.H. Act, 1875, and Sec. 5 of the P.H. Act Amendment Act, 1890.[1]

MODEL BYE-LAWS

For the licensing and registering of slaughter-houses, for keeping the same in a cleanly and proper state, for removing filth at least once in every twenty-four hours, and requiring such slaughter-houses to be provided with a sufficient supply of water.

Licences.—(A) Every person who shall apply to the S.A. for a licence for the erection of any premises to be used and occupied as a slaughter-house shall fill up a specified form giving particulars as to—

1. Boundaries, area, and description of the proposed site of the premises to be erected for use and occupation as a slaughter-house.

2. Description of the premises to be erected on such site:

(*a*) Nature, position, form, superficial area, and cubical contents of the several buildings therein comprised.

(*b*) Extent of paved area in such buildings, and materials to be employed in the paving of such area.

(*c*) Mode of construction of the internal surface of the walls of such buildings, and materials to be employed in such construction.

(*d*) Means of water supply—position, form, materials, mode of construction and capacity of the several cisterns, tanks, or other receptacles for water to be constructed for permanent use in or upon the premises.

(*e*) Means of drainage—position, size, materials, and mode of construction of the several drains.

(*f*) Means of lighting and ventilation.

[1] These provisions are now in force in all rural districts. See Rural District Councils (Slaughter-houses) Order, 1924, p. 445.

(*g*) Means of access for cattle from the nearest street or public thoroughfare.
(*h*) Number, position, and dimensions of the several pounds, stalls, pens, or lairs to be provided on the premises.
(*i*) Number of animals for which accommodation will be provided in such pounds, stalls, pens, or lairs, distinguishing: (1) Oxen; (2) Calves; (3) Sheep and lambs; (4) Swine.

(B). When application is made for a licence to use and occupy existing premises as a slaughter-house, in addition to the particulars given above, the applicant must state: situation and boundaries of the premises to be used and occupied as a slaughter-house; the name and address of the owner of the premises; the nature and condition of the applicant's tenure of the premises: (*a*) for what term, and whether by lease or otherwise; (*b*) whether applicant is sole owner, lessee, or tenant; or whether applicant is jointly interested with any other person or persons, and if so, with whom.

Registration.—If the S.A. approve of the application, a licence shall be issued to the applicant, and must be registered by him at the office of the S.A.

Every occupier of a slaughter-house shall cause

(1) the means of ventilation to be kept in proper order and efficient action and in direct communication with the external air;

(2) the drainage to be kept in proper order and efficient action;

(3) every part of the internal surface of the walls and every part of the floor or pavement to be kept in good order and repair so as to prevent the absorption of any blood, refuse or filth, or of any offensive or noxious matter;

(4) every part of the internal surface above the floor or pavement, unless it is constructed of or covered with hard smooth impervious material and is kept properly cleansed, to be thoroughly washed with hot lime-wash at least four times in every year; that is to say, at least once during the periods between the *first* and *tenth* of *March*, the *first* and *tenth* of *June*, the *first* and *tenth* of *September*, and the *first* and *tenth* of *December* respectively, and at such other times as may be necessary for maintaining a proper state of cleanliness;

(5) every part of the floor, pavement, and fittings, and every part of the internal surface of any wall on which any blood, refuse, or filth may have been spilled or splashed, or with which any offensive or noxious matter may have been brought into contact during slaughtering or dressing, to be thoroughly washed and cleansed within *three hours* after the completion of the slaughtering or dressing;

(6) the hide or skin, fat, and offal of every slaughtered animal to be removed from the slaughter-house within *twenty-four hours* after the slaughter of the animal.

An occupier of a slaughter-house shall not

(1) keep or cause or suffer to be kept in the slaughter-house any dog or poultry;

(2) keep or cause or suffer to be kept in the slaughter-house any animal of which the flesh may be used for the food of man, unless it is being prepared for slaughter in the slaughter-house;

(3) keep or cause or suffer to be kept in the slaughter-house any animal for longer than is necessary for preparing it for slaughter;

(4) confine or cause or suffer to be confined in the slaughter-house any animal elsewhere than in proper pounds, stalls, pens, or lairs.

Every occupier of a slaughter-house shall cause the slaughter-house to be provided with a water supply, kept in proper order and efficient action, and adequate for thoroughly washing and cleansing the floor or pavement, the internal surface of the walls, and every vessel or receptacle used for the collection or removal of blood, manure, garbage, filth, or refuse.

Every occupier of a slaughter-house shall

(1) provide receptacles, properly constructed of galvanized iron or other non-

absorbent material and furnished with closely fitting covers, sufficient for collecting and removing from the slaughter-house any blood, manure, garbage, filth, or refuse;

(2) when the slaughter of any animal or the dressing of its carcass is completed cause all blood, manure, garbage, filth, or refuse to be collected and deposited in such receptacles;

(3) cause every vessel, receptacle, instrument or appliance belonging to and used in the slaughter-house to be thoroughly cleansed immediately after being used, and when not in use to be kept clean;

(4) cause the contents of any vessel or receptacle containing filth to be removed from the premises at least once in every *twenty-four hours*.

Penalties

Every person who shall offend against any of the foregoing bye-laws for the registering of slaughter-houses, for keeping the same in a cleanly and proper state, for removing filth at least once in every *twenty-four hours*, and for requiring such slaughter-houses to be provided with a sufficient supply of water, shall be liable for every such offence to a penalty of *five pounds*, and in the case of a continuing nuisance to a penalty of *ten shillings* for every day during which such nuisance shall be continued after the conviction for the first offence:

Provided nevertheless, that the justices or court before whom any complaint may be made or any proceedings may be taken in respect of any such offence may, if they think fit, adjudge the payment as a penalty of any sum less than the full amount of the penalty imposed by this bye-law.

CHAPTER III

Imported Food

ENGLAND AND WALES (including London): Public Health (Imported Food) Regulations, 1925—Public Health (Imported Food) Amendment Regulations, 1933—Public Health (Imported Milk) Regulations, 1926—Public Health (Preservatives &c., in Food) Regulations, 1925 to 1927. (See p. 466.)

SCOTLAND: Public Health (Imported Food) Regulations (Scotland), 1932—Public Health (Imported Food) Amendment Regulations (Scotland), 1933—Public Health (Preservatives, &c., in Food) Regulations (Scotland). (See p. 470.)

GREAT BRITAIN: Sale of Food Order, 1921—Food and Drugs Adulteration Act, 1928, Sec. 12. (See p. 474.)

England and Wales (including London)

Public Health (Imported Food) Regulations, 1925
Public Health (Imported Food) Amendment Regulations, 1933

Extract from Ministry of Health Circular 558, issued on the 27th March, 1925, along with the 1925 Regulations

" The classes of oversea meat which are made subject to special control are divided into two groups. The first group, which is described as ' Prohibited Meat ', and is set out in the First Schedule to the Regulations, consists of those classes of meat the importation of which is unconditionally prohibited. The second group, which is described as ' Conditionally Admissible Meat ', and is set out in the Second Schedule, consists of those classes of meat the importation of which is prohibited unless the meat is accompanied by a recognized Official Certificate of the country of origin. Meat of any class other than the classes specified in the Schedules does not require an Official Certificate, but, in common with conditionally admissible meat accompanied by such a Certificate, and with all other food, it is subject to examination, and may be seized with a view to destruction if it is found to be diseased or unsound or unwholesome or unfit for human consumption."

" The Minister wishes to draw special attention to items (*c*) and (*d*) of the First Schedule and item (*a*) of the Second Schedule. The intention is that where there is evidence that one of the deep-seated lymphatic glands has been deliberately taken out, the meat should be regarded as falling within the First Schedule, and should not be imported under any conditions. Where, however, a severed part has been so cut as just to exclude one of the glands, that part should be regarded as falling within the Second Schedule and admitted if it is accompanied by an Official

Certificate. An exception to this general rule is made by item (*e*) of the First Schedule, the effect of which is to prohibit the importation of 'short-cut heads', i.e. heads cut so as not to include the submaxillary glands."

"Attention may also be drawn to the new provisions of item (*b*) of the Second Schedule, under which an Official Certificate is now required for lard, dripping, edible tallow and other rendered fats."

"The Official Certificates which have already been recognized under the former Regulations—that is to say, those of Argentina, Australia, Belgium, Brazil, Canada, Denmark, Latvia, the Netherlands, New Zealand, Sweden, the United States of America, and Uruguay—will be recognized for the purposes of items (*a*) and (*c*) of the Second Schedule. The Minister is at present in communication through the Foreign and Colonial Offices with the Governments of these and other countries with regard to the question of recognizing Official Certificates for the purposes of item (*b*), and before the Regulations come into operation a notice will be inserted in the *London Gazette* specifying all the Certificates which will be recognized from the date of commencement. A further Circular will then be issued containing a copy of the notice."

Ministry of Health Circular, 1325, issued on the 1st May, 1933, along with the P.H. (Imported Food) Amendment Regulations, 1933

SIR,

1. I am directed by the M. of H. to forward for the information of the Authority a copy of the P.H. (Imported Food) Amendment Regulations, 1933, which will come into operation on the 1st September next.

2. Under the P.H. (Imported Food) Regulations, 1925, the importation of any edible part of a pig (including edible offal but subject to certain specified exceptions) is prohibited unless it is accompanied by an Official Certificate of the country of origin which has been recognized by the Minister as affording evidence that the meat to which it relates has been derived from an animal which was free from disease at the time of slaughter, and has been dressed or prepared and packed with all necessary precautions for the prevention of danger to public health. The principal purpose of the Amendment Regulations is to extend the existing scheme of certification so that it will apply to the edible parts of cattle, sheep and goats in the same way as to the edible parts of pigs.

3. It will be observed that the two Schedules to the Regulations of 1925 which specify respectively the classes of meat the importation of which is prohibited, and the classes of meat the importation of which is prohibited unless the meat is accompanied by a recognized Official Certificate, will be superseded by the two Schedules to the Amendment Regulations. The latter Schedules embody various amendments which experience has shown to be desirable. Reference may be made especially to the amendments to items (*c*), (*d*) and (*e*) of the First Schedule, the effect of which is to add to the category of "Prohibited meat" any carcass, or part of the carcass, of an animal from which a superficial inguinal or supramammary gland has been removed, and any tongue from which the submaxillary gland has been taken out.

4. Communication is in progress with the Governments of the countries from which meat is being exported to England and Wales with regard to the recognition of Official Certificates which shall be applicable to all meat falling within the classes specified in items (*a*) and (*c*) of the Second Schedule to the Amendment Regulation, and before those Regulations come into operation a notice will be inserted in the *London Gazette* setting out the Certificates which will be recognized as from the 1st September next. A further Circular will then be issued containing a copy of that notice.

The Public Health (Imported Food) Regulations, 1925

Part I.—Preliminary

1. These Regulations may be cited as the Public Health (Imported Food) Regulations, 1925, and shall come into operation on the 1st day of June, 1925.

2.—(1) In these Regulations unless the context otherwise requires:

" The Minister " means the Minister of Health.

" Officer of Customs and Excise " (O.C.) includes any person acting under the authority of the Commissioners of His Majesty's Customs and Excise.

" Sanitary Authority " means a Port Sanitary Authority (P.S.A.) and the Council of a Borough or Urban or Rural District which includes or abuts on any part of a Customs port which part is not within the jurisdiction of a Port Sanitary Authority.

" District " means the District of a S.A.. and in the case of a S.A. other than a Port Sanitary Authority includes the waters of any Customs port abutting on any part of their district so far as such waters are not within the district of a P.S.A.

" M.O.H." includes any duly qualified Medical Practitioner and any Assistant officer appointed or employed by a S.A. to act in the execution of these Regulations.

" L.A." means the Council of a Borough or Urban or Rural District, not being a S.A. within the meaning of these Regulations, and includes the Common Council of the City of London and the Council of a Metropolitan Borough.

" Ship " includes a vessel or boat.

" Master " used in relation to a ship includes the officer or other person for the time being in charge or command of the ship

" British Islands " means Great Britain and Ireland, the Channel Islands, and the Isle of Man.

" Oversea " means brought from a place situate elsewhere than in the British Islands.

" Article of food " means an article of food whether oversea or not which, as part of the cargo of a ship or aircraft, is brought to, or delivered or landed at a place within England or Wales either as a place of actual or appointed destination, or as a place of deposit for the purpose of transmission to a place of actual or appointed destination elsewhere in the British Islands.

" Importer " includes any person who, whether as owner, consignor or consignee, agent or broker, is in possession of or in anywise entitled to the custody or control of any article of food; and " import " shall be construed accordingly.

" Export " means remove to a place not in the British Islands.

" Cattle " includes a bull, cow, ox, heifer, calf, ram, ewe, wether, lamb, goat and kid.

" Pig " includes a boar, sow and hog.

" Meat " means pork, the flesh of cattle, any other edible part of a pig or of cattle, or a substance, compound, material or article of which pork or the flesh of cattle, or any other edible part of a pig or of cattle is an ingredient.

" Prohibited Meat " means any of the kinds of oversea meat specified in the First Schedule to these Regulations.

" Conditionally admissible meat " means any of the kinds of oversea meat specified in the Second Schedule to these Regulations.

" Official Certificate " means a certificate, label, mark, stamp or other voucher which is affixed to oversea meat or to a package containing such meat by a competent authority in the country of origin and is for the time

being recognized by the Minister as evidence that the meat to which it relates has been derived from an animal which was free from disease at the time of slaughter and has been dressed or prepared and packed with all necessary precautions for the prevention of danger to public health.

(2) The recognition of an official certificate for the purpose of these Regulations shall be effected by means of a notice published in the *London Gazette* which shall specify the conditions (if any) subject to which the certificate is recognized; and any such notice may be varied or revoked by a subsequent notice published in the *London Gazette.*

(3) The Interpretation Act, 1889, applies to the interpretation of these Regulations as it applies to the interpretation of an Act of Parliament.

3. From the date of commencement of these Regulations, the P.H. (Foreign Meat) Regulations, 1908, the P.H. (First Series; Unsound Food) Regulations, 1908, and the P.H. (Foreign Meat) Amending Regulations, 1909, shall be revoked, but without prejudice to the effect of any notice, certificate, proceedings or other thing given, issued, begun, or done in pursuance of such Regulations; and all Orders made under those Regulations shall continue in force until altered or revoked as if they were made under these Regulations and any reference in any such Order to any provisions of the revoked Regulations shall have effect as if the reference were to the corresponding provisions of these Regulations.

4.—(1) Subject to such provisions of these Regulations as prescribe functions to be exercised by the O.C. and by the M.O.H. and any other officer of a S.A., the S.A. shall enforce and execute these Regulations:

Provided that a S.A. and a L.A., or two or more S.A.s or L.A.s shall act together for any of the purposes of these Regulations in every case in which the Minister by Order requires any such joint action, and in every such case these Regulations shall have effect subject to such adaptations and modifications as are made by the Order.

(2) If the Minister after due inquiry is satisfied that a S.A. or L.A. or their officers have failed to enforce and execute any of the provisions of these Regulations he may appoint some person to execute and enforce such provisions and the provisions of Sec. 299 of the P.H. Act, 1875, shall apply as regards any such appointment.

5. Where a vehicle containing articles of food is landed in Great Britain and with the consent of the Commissioners of Customs and Excise the Customs examination of such vehicle is deferred until the vehicle reaches a place of destination in England or Wales, or where articles of food are brought by aircraft, these Regulations shall apply to such articles of food with all necessary modifications, including the substitution throughout the Regulations of the terms and expressions set out in the second column of the following table for the terms and expressions set out in the first column:

Terms and Expressions used in Regulations	Terms and Expressions to be substituted
Ship	Vehicle or aircraft.
Cargo	Contents of vehicle or aircraft.
Master	Person having charge of vehicle or aircraft.
Sanitary Authority ..	Local Authority (where place of destination or arrival is not within a Customs Port).
Land	Unload.

Part II.—All Food

6. A person shall not import into England or Wales for sale for human consumption any article of food which has been examined by a competent authority and not found at the time of examination to be fit for human consumption or any article of food in the manufacture or preparation of which any such article as aforesaid has been used.

7.—(1) The M.O.H. may examine any article of food which had been landed within the District and where the circumstances, in his opinion, so require, he may examine an article of food while it is on board a ship within the District, or after it has been delivered overside, and before it has been landed.

(2) The Master of a ship, and every person having the custody of any lands or premises within the District shall, at the request of the M.O.H., afford him access to the ship, or to the lands or premises, at any reasonable time, for the examination of an article of food which is on board the ship, or which has been deposited on the lands or premises.

(3) The importer, the Master of the ship, and every person having the custody of any lands or premises shall, at the request of the M.O.H., afford by the convenient and suitable arrangement. unpacking or uncovering of so much of the cargo, or of any consignment delivered overside or landed, or deposited on the lands or premises, as comprises articles of food, all such facilities as the M.O.H. may reasonably require for the examination of the article of food. He shall also afford such other facilities as the M.O.H. may reasonably require for the purposes of these Regulations.

(4) Where the M.O.H. has reason to believe that an article of food, which has been landed within the District, is deposited on any lands or premises within the District, and access to the lands or premises at a reasonable time, for the examination of the article of food by the M.O.H., has been refused by the person having the custody of the lands or premises, the M.O.H. may make complaint to a Justice.

The Justice may thereupon by a warrant authorize the M.O.H. to enter the lands or premises, and to search for, and examine any article of food deposited thereon.

The Person having the custody of the lands or premises named in the warrant shall, at any reasonable time, afford all such facilities as the M.O.H. may reasonably require to enable him, by an assistant or otherwise, to search for and examine the article of food.

(5) Where the duties of an O.C. with respect to the examination of a cargo or consignment comprising an article of food have not been wholly discharged, an examination of the article of food for the purpose of these Regulations shall not be made without the consent of such Officer, but every O.C. shall afford such facilities as the circumstances require for the examination of the article of food in pursuance of these Regulations.

8.—(1) The M.O.H. may take a sample from a consignment of articles of food for any purpose of these Regulations, and, subject to paragraph (2) of this Article, shall dispose of the sample in such manner as the S.A. direct.

(2) Where the M.O.H. who takes a sample from a consignment of articles of food is of opinion that special procedure is necessary for the examination of the articles of food, or where, at the request of the importer, the M.O.H. who takes any such sample has recourse to special procedure for the examination of the articles of food, the importer and every person who has the custody or control of the consignment shall afford all such facilities as the M.O.H. may reasonably require for the completion of his examination of the articles of food, and, during such time, not exceeding forty-eight hours, as the M.O.H. by notice in writing appoints, or during any longer time which he by notice in writing appoints and to

which the importer consents, he shall not, without the permission of the M.O.H., remove any such articles of food except to any such place as may be specified in the notice.

9.—(1) If, on examination, the M.O.H. is of opinion that an article of food is diseased or unsound or unwholesome, or unfit for human consumption, he may himself, or by an assistant, seize and carry away the article of food and apply to a Justice to deal with the same under Article 15 or he may by a notice in writing to the importer, or to the Master of the ship, or to any other person having charge of the article of food, require that, until it has been dealt with by a Justice, it shall not, without the permission of the M.O.H., be removed from the place of examination or from any other place specified in the notice.

(2) Neither the importer nor the Master of the ship nor any other person shall, without the permission of the M.O.H., remove an article of food in relation to which a notice has been given in pursuance of this Article from the place at which the M.O.H. has examined it, or such other place as is specified in the notice, until it has been dealt with by a Justice and such Justice has authorized its removal.

Part III.—Oversea Meat

10. A person shall not import into England or Wales for sale for human consumption any conditionally admissible meat without an official certificate or any prohibited meat.

11.—(1) The O.C. on the arrival of a ship within the District shall ascertain whether the cargo of the ship comprises any oversea meat.

(2) Where it appears to the O.C. to be desirable that any oversea meat should be examined by the M.O.H. either with a view to ascertaining whether it includes any conditionally admissible meat without an Official Certificate or any prohibited meat or for any other purpose of these Regulations he shall by a notice in writing given to the Master or to the importer require that until the meat has been examined by the M.O.H. it shall not be removed from the place specified in the notice.

The O.C. shall at the same time inform the M.O.H. of the effect of the notice.

(3) The M.O.H. shall forthwith examine any meat in respect of which a notice has been given by an O.C. under this Article.

(4) If upon the examination of any oversea meat the M.O.H. is of opinion that it comprises conditionally admissible meat without an Official Certificate or prohibited meat he shall by a notice in writing forbid the removal of the meat for any purpose other than exportation.

He shall send a copy of every such notice to the S.A. and where the O.C. has given a notice under this Article in respect of such meat he shall also send a copy to that Officer.

(5) If upon the examination of any meat in respect of which the O.C. has given a notice under this Article the M.O.H. is of opinion that the meat does not comprise any conditionally admissible meat without an Official Certificate, any prohibited meat, or any meat which is diseased or unsound or unwholesome or unfit for human consumption, he shall give a certificate authorizing the removal of the meat and he shall give a copy of the certificate to the O.C.

12.—(1) The S.A., within twelve hours after the receipt of a copy of a notice by the M.O.H. given in pursuance of paragraph (4) of Article 11 with respect to any oversea meat, shall give to the importer notice in writing that, unless, within the time specified in the notice not being less than twelve hours after the receipt thereof he gives a written undertaking to export the meat at his own expense, or to prove in proceedings before a Justice that the meat is not intended for sale for human consumption, the meat will be destroyed or disposed of under the super-

vision of the M.O.H. by such means and in such a manner as to prevent its being used for human consumption.

(2) If within the time specified in the notice, the S.A. have not received such a written undertaking as is described in the notice or if within that time they have received an undertaking that the importer will at his own expense export the meat, and within three days after the receipt of the undertaking the importer fails to export the meat, the S.A. may cause the meat to be destroyed or disposed of under the supervision of the M.O.H. by such means and in such a manner as to prevent its being used for human consumption.

(3) Where in pursuance of this Article the importer has given an undertaking to prove that any meat is not intended for sale for human consumption the S.A. shall within twenty-four hours after the receipt of the undertaking take steps to obtain the decision of a Justice with respect thereto.

13.—(1) Where in pursuance of Article 11 the O.C. or the M.O.H. has given a notice forbidding the removal of any meat a person shall not remove such meat contrary to the terms of the notice except with the express permission of the Officer by whom the notice was given.

(2) A person shall not land any meat which has been exported in compliance with an undertaking given under these Regulations or under any similar Regulations in force in any part of the British Islands.

PART IV.—JUDICIAL PROCEEDINGS, ETC.

14. For the purposes of these Regulations an application may be made to any Justice having jurisdiction in the District, and thereupon subsection (2) of Sec. 28 of the P.H. Acts Amendment Act, 1890, whether that subsection is or is not in force in the District, and any provision in any Act of Parliament which applies to a proceeding under or consequent upon that subsection, shall have effect in relation to the proceedings, as if the application were a complaint within the meaning of the said subsection and otherwise subject to the provisions of these Regulations.

15.—(1) Where in pursuance of these Regulations an application is made to a Justice in respect of an article of food and the Justice is satisfied

(*a*) that the article of food is diseased or unsound or unwholesome, or unfit for human consumption, or

(*b*) in the case of meat in respect of which an undertaking in that behalf has been given under Article 12 that the importer has failed to prove that the meat is not intended for sale for human consumption,

he shall condemn the article of food and order it to be destroyed or disposed of under the supervision of the M.O.H. by such means and in such a manner as to prevent its being used for human consumption.

(2) Where on such application the Justice is satisfied that the article of food is not intended for sale for human consumption, he shall order the return of such article to the person entitled thereto or the rescission of the notice prohibiting the removal thereof, as the case may require.

(3) The Justice shall in every Order under this Article set forth the description of, and such other details as will suffice to identify, the article of food, together with the name, description and address of the importer and of the person to whom it is to be delivered; and he shall forthwith furnish the S.A. with a copy of the Order.

16. If a difference arises in relation to any subject matter of, or to anything done under, these Regulations, the difference may, on the application of all the parties affected, be referred to the Minister for determination and the Minister may by Order determine the difference, and such determination shall be final and conclusive.

PART V.—GENERAL

17. Any notice or certificate given by a S.A. or a M.O.H. or any undertaking given by an importer under these Regulations may be given by properly addressing prepaying and posting a letter containing the notice, certificate or undertaking.

18. Where, in pursuance of these Regulations, an article of food is destroyed or otherwise disposed of under the supervision of the M.O.H., the S.A. before the destruction or other disposal of the article of food shall cause the description of, and such other details as will suffice to identify, the article of food to be duly recorded, and shall keep the record in their custody for a period of not less than twelve months.

19. A person shall, if so required, give to the O.C. or the M.O.H. acting in the execution of these Regulations, all reasonable assistance in his power, and shall, in relation to anything within his knowledge, furnish any such officer with all information he may reasonably require for the purposes of these Regulations, and a person, in relation to anything within his knowledge and material to any purpose of proceedings in pursuance of these Regulations shall make a true statement and truly answer any question, when required or put by a Justice or other competent authority in the course and for any purpose of those proceedings.

20.—(1) The S.A. may, with the consent of the Minister, appoint and pay a legally qualified Medical Practitioner to act in the execution of these Regulations, either in the place of, or as an assistant to, the M.O.H.

(2) The S.A. may also, with the consent of the Minister, appoint or employ and pay an Assistant Officer to act, under the direction of the M.O.H., in the exercise of any such powers or in the discharge of any such duties of the M.O.H. under these Regulations as the S.A. assign to the person so appointed.

FIRST AND SECOND SCHEDULES

The first and second schedules to the P.H. (Imported Food) Regulations, 1925, have been superseded by the two Schedules to the P.H. (Imported Food) Amendment Regulations, 1933. (See p. 461.)

The Public Health (Imported Food) Amendment Regulations, 1933, dated April 25, 1933, made by the Minister of Health

1. These regulations may be cited as the P.H. (Imported Food) Amendment Regulations, 1933, and shall come into operation on the 1st day of September, 1933, and be read as one with the principal regulations.

2. For the definitions of the terms "cattle" and "meat" in paragraph (1) of article 2 of the principal regulations there shall be substituted the following definitions:

> "Animal" includes a bull, cow, ox, heifer, calf, ram, ewe, wether, lamb, goat, kid, boar, sow and hog;
>
> "Meat" means the flesh or any other edible part of an animal or a substance compound material or article of which the flesh or any other edible part of an animal is an ingredient.

3. For the first and second schedules to the principal regulations there shall be substituted the first and second schedules to these regulations.

4. Copies of the principal regulations printed under the authority of His Majesty's Stationery Office may be printed with any additions, omissions or substitutions directed to be made by these or any other amending regulations but with a footnote in each instance referring to such amending regulations and the principal regulations so printed may be cited as the P.H. (Imported Food) Regulations.

FIRST SCHEDULE

Prohibited Meat

Any of the following kinds of meat:

(*a*) Scrap meat, that is to say meat which consists of scraps, trimmings or other pieces (whether with or without bone) of such shape or in such condition as to afford insufficient means of identification with a definite part of a carcass, and which has not before importation been made ready for human consumption in the form of a sausage or other prepared or manufactured article of food;

(*b*) Meat comprising the ribs or the abdominal wall from which the pleura or the peritoneum has been detached;

(*c*) The carcass of an animal having the head in its natural state of attachment to the carcass but not having the submaxillary, prescapular, precrural, superficial inguinal, supramammary, and popliteal glands in their natural position;

(*d*) A severed part of the carcass of an animal (including the whole carcass without the head) from which a prescapular, precrural, popliteal, superficial inguinal, or supramammary gland has been taken out; and

(*e*) The head of an animal without the submaxillary gland or a tongue from which the submaxillary gland has been taken out.

SECOND SCHEDULE

Conditionally Admissible Meat

Any of the following kinds of meat so far as they are not included in the first schedule:

(*a*) A severed part of the carcass of an animal (including the head or any part thereof and the whole carcass without the head but not including any part of the carcass of a pig which has been salted, cured, pickled, dried or smoked, or otherwise prepared in the manner in which bacon or ham is ordinarily prepared) from which no submaxillary, prescapular, precrural, superficial inguinal, supramammary, or popliteal gland has been taken out;

(*b*) Lard, dripping, edible tallow, and all other rendered animal fats except oleo oil, oleo stearine and premier jus; and

(*c*) All edible parts of an animal other than (i) the head or other severed parts of the carcass, (ii) the intestines prepared in the form of sausage casings, and (iii) meat which has before importation been made ready for human consumption in the form of a sausage or other prepared or manufactured article of food.

Public Health (Imported Milk) Regulations, 1926

These Regulations require the registration by Port and Riparian Sanitary Authorities of persons receiving imported milk and empower the registering authorities to refuse registration or to remove a person from the register if the requirements of the Regulations in regard to the condition of the milk are not complied with. These requirements are that the milk must not contain more than 100,000 bacteria per cubic centimetre, and must be free from tubercle bacilli.

The decision of a S.A. to remove a person from the register is subject to appeal in the first instance to a court of summary jurisdiction, and the decision of that court may be reviewed on appeal to a court of quarter sessions.

Scotland

Public Health (Imported Food) Regulations (Scotland), 1932

Public Health (Imported Food) Amendment Regulations (Scotland), 1933

The provisions of these Regulations are generally similar to those in the English Imported Food Regulations. The following differences may, however, be noted.

1. In England the officer of the S.A. empowered to execute the Regulations is the M.O.H. or any duly qualified medical practitioner appointed (with the consent of the Ministry of Health) to act in the place of or as assistant to the M.O.H. or any Assistant Officer appointed or employed (with the consent of the Ministry of Health) by the S.A.

In Scotland the function is performed by the " Responsible Officer ", that is to say:

(*a*) for the purposes of Part II of the Regulations (Provisions as to importation, examination, and seizure of all articles of food):

(i) the M.O.H.;
(ii) the S.I.;
(iii) the V.S. approved for the purposes of Sec. 43 of the P.H. (Scotland) Act, 1897.

(*b*) for the purposes of Part III of the Regulations (Special provisions as to Oversea Meat):

(i) the M.O.H.;
(ii) the V.S. approved as aforesaid;
(iii) the M.I. acting under the Regulations made by the D. of H. (Scotland) with respect to the inspection of meat.

The term " Responsible Officer " also includes any Assistant Officer appointed by the L.A. (with the consent of the D. of H. (Scotland) to act in the execution of the Regulations.

2. In Scotland in the case of food found on examination by the responsible officer to be diseased, or unsound, or unwholesome, or unfit for human consumption, seizure may not take place if the importer gives a satisfactory undertaking in writing that the article will be exported or that it will not be sold for human consumption. The English Regulations do not limit the right of seizure in this way.

Great Britain

The Sale of Food Order, 1921

This Order of the Board of Trade came into operation on 1st September, 1921. Save as regards the labelling of imported meat, the Order has been revoked and it remains in force so far as meat is concerned by virtue of the Expiring Laws Continuation Acts.

Part III.—Labelling of Imported Produce

The authority for the enforcement of the provisions relating to this part of the Order in regard to the labelling of imported meat is the L.A. under the Food and Drugs (Adulteration) Act.

Definitions.—" Meat " shall include beef, mutton, lamb, pork, and veal, but shall not include bacon or ham, or cooked, canned, or potted meat, sausages, or offals.

Meat.—A person shall not expose for sale by retail any imported meat unless the article bears at the time of exposure for sale a label with the word " Imported ", or with a word or words disclosing the country of origin of the article clearly printed thereon so as to be easily readable by the customers. Provided that, where only imported meat is exposed for sale on any slab, rail, or counter, it shall be sufficient compliance with the requirements of this clause if the slab, rail, or counter bears in a conspicuous position such a label. Provided, also, that where all the meat for the time being on sale in any premises is imported meat, it shall be a sufficient compliance with the requirements of this clause if there be exhibited on the premises in a conspicuous position, and so as to be easily readable by the customers, a notice stating that imported meat only is on sale.

Provided, also, that where pieces of home-killed and imported meat, not exceeding in any case 1 lb. in weight, are exposed for sale on a slab, tray, or counter, the foregoing provisions of this clause shall not apply to the imported meat so exposed, provided that the slab, tray, or counter bears in a conspicuous position a notice containing the words " mixed home-killed and imported meat " clearly printed thereon.

Part VI.—General

Every L.A. is authorized to execute and enforce the provisions of this Order within their area, and except in Scotland to institute proceedings for any offences against the Order.

CHAPTER IV

Purity of Food

ENGLAND AND WALES (including London): Public Health (Dried Milk) Regulations, 1923 and 1927—Public Health (Condensed Milk) Regulations, 1923 and 1927—Public Health (Preservatives, &c., in Food) Regulations, 1925 to 1927—Artificial Cream Act, 1929.

SCOTLAND: Public Health (Preservatives, &c., in Food) Regulations (Scotland)—Public Health (Dried Milk) Regulations (Scotland), 1931—Public Health (Condensed Milk) Regulations (Scotland), 1931.

GREAT BRITAIN: Sale of Milk Regulations, 1901 and 1912—Sale of Butter Regulations, 1902—Public Health (Regulations as to Food) Act, 1907—Milk and Dairies (Amendment) Act, 1922, Sec. 4—Food and Drugs (Adulteration) Act, 1928.

Note.—Most of the legal provisions cited above are in England and Wales administered by Food and Drugs Authorities, and it is convenient that they should be treated for purposes of administration as constituting a single group of laws for securing the purity of food.

England and Wales (including London)

Public Health (Dried Milk) Regulations, 1923 and 1927

These Regulations apply to dried milk to which no other substance has been added to the dried milk contained in any powder or solid of which not less than 70 per cent consists of dried milk. The more important provisions of these Regulations are as follows:

Dried milk, sold or intended for sale (other than dried milk contained in a receptacle whose gross weight exceeds 10 lb.), must contain not less than the following percentages of milk fat, namely:

In the case of milk described as dried full cream milk 26 per cent.

In the case of milk described as dried three-quarter cream milk 20 per cent.

In the case of milk described as dried half cream milk 14 per cent; and

In the case of milk described as dried quarter cream milk 8 per cent.

Receptacles, with the exception of those whose gross weight exceeds 10 lb., must be labelled as follows:

1.—(1) Every tin or other receptacle containing dried milk (other than dried milk to which sugar or some other substance has been added) shall bear a label

upon which is printed such one of the following declarations as may be applicable or such other declaration substantially to the like effect as may be allowed by the Minister:

(i) In the case of full cream milk:

DRIED FULL CREAM MILK THIS TIN CONTAINS THE EQUIVALENT OF (a) PINTS OF MILK

(ii) In the case of partly skimmed milk, that is to say, dried milk containing not less than 8 per cent but less than 26 per cent of milk fat:

DRIED PARTLY SKIMMED MILK (b) CREAM SHOULD NOT BE USED FOR BABIES EXCEPT UNDER MEDICAL ADVICE THIS TIN CONTAINS THE EQUIVALENT OF (a) PINTS OF (b) CREAM MILK

(iii) In the case of skimmed milk, that is to say, dried milk containing less than 8 per cent of milk fat:

DRIED MACHINE-SKIMMED MILK (OR DRIED SKIMMED MILK) UNFIT FOR BABIES THIS TIN CONTAINS THE EQUIVALENT OF (a) PINTS OF SKIMMED MILK

(i) There shall be added to the heading the word " Sweetened " if the only substance added to the milk is sugar; the word " Modified " if the only substance added is a constituent of milk, and the word " Compounded " in every other case; and

(ii) The words " with (*c*) added " shall be added to the last sentence in each case, words being inserted at (*c*) to specify the substance or substances added.

(3) The declaration shall be completed as follows:

(i) There shall be inserted at (*a*) the appropriate number in words and figures, e.g. " one and a half ($1\frac{1}{2}$) ", any fraction being expressed as eighths, quarters, or a half.

(ii) There shall be inserted at (*b*) the word " Three-quarter " if the percentage of milk fat is not less than 20; " Half " if such percentage is less than 20 but not less than 14; and " Quarter " if such percentage is less than 14 but not less than 8.

(4) For the purposes of this Rule the terms " Milk ", " Three-quarter cream milk ", " Half cream milk ", and " Quarter cream milk " mean milk containing not less than the following percentages of milk fat and milk solids, that is to say:

	Milk Fat	Milk Solids (including fat)
Milk	3·6	12·4
Three-quarter cream milk	2·7	11·6
Half cream milk	1·8	10·8
Quarter cream milk	·9	9·9

and " Skimmed milk " means milk which contains not less than 9 per cent of milk solids other than milk fat.

Public Health (Condensed Milk) Regulations, 1923 and 1927

The Regulations require the labelling of every tin of condensed milk in a manner somewhat similar to that prescribed in the P.H. (Dried Milk) Regulations.

The labels must declare whether the milk is full cream or skimmed, sweetened or unsweetened, and a statement that the tin contains the equivalent of so many pints of milk (or skimmed milk). In the case of condensed skimmed milk the label must bear the declaration " Unfit for Babies ".

The prescribed declaration is required to be printed in a similar manner to that required by the P.H. (Dried Milk) Regulations.

Condensed milk shall contain not less than the appropriate percentages of milk fat and milk solids as specified in the following Table:

Description of Condensed Milk	Percentage of Milk Fat	Percentage of all Milk Solids, including Fat
1. Full cream, unsweetened ..	9·0	31·0
2. Full cream, sweetened ..	9·0	31·0
3. Skimmed, unsweetened ..	—	20·0
4. Skimmed, sweetened ..	—	26·0

The Regulations do not apply in cases where the condensed milk is intended to be exported, or is contained in a receptacle whose gross weight exceeds 5 lb.

It may also be noted that, unlike the Dried Milk Regulations, the Condensed Milk Regulations (Part III) specifically empower officers of Customs and Excise to enforce the Regulations in regard to imports.

Public Health (Preservatives, &c., in Food) Regulations, 1925–27

The Regulations, which apply to imported as well as to food produced in England and Wales, prohibit the use of any preservative except sulphur dioxide and benzoic acid in specified amounts in specified foods. In certain instances the presence of a preservative must be declared on a specified label. The use of certain colouring matters is prohibited, and, with the exception of cane or beet sugar, no thickening substance may be added to cream.

The following are the schedules to the Regulations:

THE FIRST SCHEDULE

Part I.—Articles of Food which may contain Preservative and Nature and Proportion of Preservative in each Case

The articles of food specified in the first column of the following Table may contain the preservative specified in the second column in proportions not exceeding the number of parts (estimated by weight) per million specified in the third column:

Food	Preservative	Parts per Million
1. Sausages and sausage meat containing raw meat, cereals and condiments.	Sulphur dioxide ..	450
2. Fruit and fruit pulp (not dried) for conversion into jam or crystallized glacé or cured fruit as defined in items 6 and 7:		
(*a*) Cherries	Do.	3,000
(*b*) Strawberries and raspberries	Do.	2,000
(*c*) Other fruit	Do.	1,500
3. Dried fruit:		
(*a*) Apricots, peaches, nectarines, apples and pears.	Do.	2,000
(*b*) Raisins and sultanas ..	Do.	750
4. Unfermented grape juice and non-alcoholic wine made from such grape juice if labelled in accordance with the rules contained in the Second Schedule to these Regulations.	Benzoic acid	2,000
5. Other non-alcoholic wines, cordials and fruit juices, sweetened or unsweetened.	Either Sulphur dioxide or Benzoic acid ..	350 600
6. Jam (including marmalade and fruit jelly prepared in the way in which jam is prepared).	Sulphur dioxide ..	40
7. Crystallized glacé or cured fruit (including candied peel).	Do.	100
7a. Fruit and fruit pulp not otherwise specified in this Schedule.	Do.	350
8. Sugar (including solid glucose) and cane syrups.	Do.	70
8a. Cornflour (maize starch) and other prepared starches.	Do.	100
9. Corn syrup (liquid glucose) ..	Do.	450
10. Gelatine	Do.	1,000
11. Beer	Do.	70
12. Cider	Do.	200
13. Alcoholic wines	Do.	450
14. Sweetened mineral waters	Either Sulphur dioxide or Benzoic acid ..	70 120
15. Brewed ginger-beer	Benzoic acid	120
16. Coffee extract	Do.	450
17. Pickles and sauces made from fruit or vegetables.	Do.	250

Part II.—Colouring Matters which may not be added to Articles of Food

1. *Metallic Colouring Matters*

Compounds of any of the following metals:

Antimony,	Copper,
Arsenic,	Mercury
Cadmium,	Lead,
Chromium,	Zinc.

2. *Vegetable Colouring Matter*

Gamboge

3. *Coal Tar Colours*

'Number in Colour Index of Society of Dyers and Colourists, 1924	Name	Synonyms
7	Picric Acid	Carbazotic Acid.
8	Victoria Yellow	Saffron Substitute; Dinitrocresol.
9	Manchester Yellow	Naphthol Yellow; Martius Yellow.
12	Aurantia	Imperial Yellow.
724	Aurine	Rosolic Acid; Yellow Coralline.

THE SECOND SCHEDULE

Labelling of Articles of Food containing Preservative and of Preservatives

1. The articles of food containing preservative to which the Rules as to labelling set out in this Schedule apply are sausages, sausage-meat, coffee extract, pickles, and sauces, and (where the proportion of benzoic acid exceeds 600 parts per million) grape juice and wine.

2.—(1) Where any of the said articles of food contains preservative it shall bear a label on which is printed the following declaration or such other declaration substantially to the like effect as may be allowed by the Minister:

(a)	CONTAIN(S)
PRESERVATIVE	

(2) The declaration shall be completed by inserting at (*a*) the word "This" or "These", followed by the name of the food as used in paragraph 1 of this Schedule.

(3) In the case of grape juice or wine to which these Rules apply there shall be added to the declaration the words "and is not intended for use as a beverage".

3.—(1) An article sold as a preservative shall bear a label on which is printed the following declaration or such other declaration substantially to the like effect as may be allowed by the Minister:

THIS PRESERVATIVE CONTAINS
(a) PER CENT OF SULPHUR DIOXIDE

(2) Where the article contains benzoic acid the words "Benzoic Acid" shall be substituted for the words "Sulphur Dioxide".

(3) The declaration shall be completed by inserting at (*a*) in words and figures, excluding fractions (e.g. "seventy (70)") the true percentage of the sulphur dioxide or benzoic acid present in the article.

4. The prescribed declaration shall in each case be printed in dark block type upon a light coloured ground within a surrounding line and no other matter shall be printed within such surrounding line. The type used shall be not less than one-eighth of an inch in height, or, in the case of grape juice or wine to which these Rules apply, one-sixteenth of an inch in height.

5. The label shall be securely affixed to the article or be part of or securely affixed to the wrapper or container, and in any case shall be so placed as to be clearly visible. If the article bears a label containing the name, trade mark, or design representing the brand of the article or the name and address of the manufacturer or dealer the prescribed declaration shall on and after the 1st day of July, 1927, be printed as part of such label.

6. No comment on or explanation of the prescribed declaration (other than any direction as to use in the case of a preservative) shall be placed on the label or on the wrapper or container.

Artificial Cream Act, 1929

The Act relates to the substance commonly known as reconstituted cream which is usually prepared by emulsifying butter, dried skimmed milk, and water. The Act defines cream and artificial cream, respectively, in the following manner:

> "'Cream' means that portion of natural milk rich in milk-fat which has been separated by skimming or otherwise."
>
> "'Artificial cream' means an article of food resembling cream and containing no ingredient which is not derived from milk except water or any ingredient or material which by virtue of the proviso to Subsection (2) of Sec. 2 of the Food and Drugs (Adulteration) Act, 1928, may lawfully be contained in an article sold as cream."

The main provisions of the Act are that artificial cream shall not be sold under a description or designation including the word "cream" unless that word is immediately preceded by the word "artificial". Receptacles used for conveying artificial cream or for containing it when it is exposed for sale must be labelled with the words "artificial cream" in large and legible type. With certain specified exceptions, premises where artificial cream is manufactured or sold must be registered with the F.D.A., but this requirement does not apply to the manufacture on any premises of artificial cream for use in the preparation on those premises of some article of food. Where an article having the composition of cream or artificial cream is sold on premises so registered, it shall be presumed to be artificial cream unless the contrary is proved.

Scotland

Public Health (Preservatives, &c., in Food) Regulations (Scotland)

These Regulations are substantially the same as the English Regulations. The following points of difference may, however, be noted:

(*a*) In the Scottish Regulations there is no prohibition of the sale or importation for sale of cream containing thickening substance, but it should be noted that Article II of the Milk and Dairies (Scotland) Order, 1925, prohibits the addition of colouring or thickening matter to cream.

(*b*) In Scotland mince (butcher meat minced) is allowed to contain 450 parts of sulphur dioxide per million, but only during June, July, August, and September in any year and subject to a declaration of the presence of any such preservative.

Public Health (Dried Milk) Regulations (Scotland), 1931
Public Health (Condensed Milk) Regulations (Scotland), 1931

The Scottish Regulations relating to dried milk and condensed milk contain provisions similar to those in operation in England and Wales.

Great Britain

Sale of Milk Regulations, 1901

1. Where a sample of milk (not being milk sold as skimmed, or separated, or condensed, milk) contains less than 3 per cent of milk fat, it shall be presumed, for the purposes of the Food and Drugs (Adulteration) Act, 1928, until the contrary is proved, that the milk is not genuine, by reason of the abstraction therefrom of milk fat, or the addition thereto of water.

2. Where a sample of milk (not being milk sold as skimmed, or separated, or condensed, milk) contains less than 8·5 per cent of milk solids other than milk fat, it shall be presumed, for the purposes of the Food & Drugs (Adulteration) Act, 1928, until the contrary is proved, that the milk is not genuine, by reason of the abstraction therefrom of milk solids other than milk fat, or the addition thereto of water.

Sale of Milk Regulations, 1912

Where a sample of skimmed or separated milk (not being condensed milk) contains less than 8·7 per cent of milk solids other than milk fat, it shall be presumed, for the purposes of the Food and Drugs (Adulteration) Act, 1928, until the contrary is proved, that the milk is not genuine, by reason of the abstraction therefrom of milk solids other than milk fat, or the addition thereto of water.

Sale of Butter Regulations, 1902

Where the proportion of water in a sample of butter exceeds 16 per cent it shall be presumed, for the purposes of the Food and Drugs (Adulteration) Act, 1928, until the contrary is proved, that the butter is not genuine by reason of the excessive amount of water therein.

(See also Food and Drugs (Adulteration) Act, 1928, Sec. 11.)

Public Health (Regulations as to Food) Act, 1907

This Act applies to the United Kingdom including London:

1.—(1) The power given to the Central Health Authorities (now the M. of H.) and the D. of H. (Scotland) under the P.H. Act, 1896, or Part IV of the P.H. (Scotland) Act, 1897, and the enactments therein mentioned is extended to the making of regulations authorizing measures to be taken for the prevention of danger to public health, from the importation, preparation, storage, and distribution of food or drink (other than drugs or water).

Such regulations may:

(*a*) Provide for the examination and taking of samples of any such articles;

(*b*) apply, as regards any matters to be dealt with by the regulations, any provision in any Act of Parliament dealing with like matters, with the necessary modifications and adaptations;

(*c*) provide for the recovery of any charges authorized to be made by the regulations for the purposes of the regulations or any services performed thereunder.

(2) For the purposes of regulations made under this Act, articles commonly used for the food or drink of man shall be deemed to be intended for sale for human consumption unless the contrary is proved.

The following regulations have been made; wholly or partly under the powers conferred by this Act:

England and Wales

P.H. (Shellfish) Regulations, 1915.
P.H. (Condensed Milk) Regulations, 1923.
P.H. (Dried Milk) Regulations, 1923.
P.H. (Meat) Regulations, 1924.
P.H. (Imported Food) Regulations, 1925.
P.H. (Preservatives, &c., in Food) Regulations, 1925–27.
P.H. (Prevention of Tuberculosis) Regulations, 1925.
P.H. (Imported Milk) Regulations, 1926.
P.H. (Condensed Milk) Amendment Regulations, 1927.
P.H. (Dried Milk) Amendment Regulations, 1927.
P.H. (Imported Food) Amendment Regulations, 1933.

Scotland

P.H. (Condensed Milk) Regulations (Scotland), 1931.
P.H. (Dried Milk) Regulations (Scotland), 1931.
P.H. (Meat) Regulations (Scotland), 1932.
P.H. (Preservatives, &c., in Food) Regulations (Scotland).
P.H. (Imported Food) Regulations (Scotland), 1932.
P.H. (Imported Food) Amendment Regulations (Scotland), 1933.

Milk and Dairies (Amendment) Act, 1922

Sec. 4. prohibits the addition of any colouring matter or water or any dried or condensed milk or any fluid reconstituted therefrom or any skimmed milk or separated milk to milk intended for sale. It also prohibits the sale as milk of any liquid in the making of which dried milk or condensed milk has been used. For the purposes of this section, except as regards the addition of skimmed or separated milk, milk includes skimmed and separated milk.

Food and Drugs (Adulteration) Act, 1928

The Act is divided into five parts, the more important provisions of which are summarized below:

1.—General

Sec. 1. Mixing, etc.—No person shall mix, colour, stain or powder any article of food or drug so as to render it injurious to health, and in the case of drugs to affect its quality or potency. No person shall sell an article of food or drug so treated. Any person convicted of contravention is liable to a fine up to £50, or, after a first offence, to imprisonment, unless he satisfies the court that he did not know, and could not with reasonable diligence have ascertained that the article of food or drug sold by him was so mixed, coloured, stained or powdered as aforesaid. The addition of any preservative or other ingredient to food in contravention of regulations made under the P.H. (Regulations as to Food) Act, 1907, shall be deemed to render the food injurious.

Sec. 2. Nature, Substance or Quality.—No person shall sell to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance or quality demanded by the purchaser, but no offence is held to have been committed if material not injurious to health has been added to the article of food or drug to render it fit for carriage or consumption and not fraudulently to increase bulk, weight, or measure; or when it conforms to the specification of a patent; or where extraneous matter has been unavoidably mixed in the collection or preparation; or, in the case of whisky, brandy, rum or gin, where water has been added so as not to reduce the spirit more than 35 degrees under proof. Unless the contrary is proved, the purchaser shall be deemed to have demanded an article complying with any regulations made under the P.H. (Regulations as to Food) Act, 1907.

Secs. 3 and 4. Compounds.—The provisions of (2) apply generally to compound articles of food or drugs, but in certain cases no offence is committed if the food or drug is properly labelled as mixed.

Sec. 5. Abstraction.—If any person abstracts from any article of food any part of it so as to affect injuriously its nature, substance or quality, with the intent that it may be sold in its altered state without notice, or if any person sells any article so altered without making disclosure of the alteration, he shall be guilty of an offence.

2.—Special Articles

Sec. 6. Labelling, etc., of Margarine, Margarine Cheese, and Milk-blended Butter.—Margarine, margarine cheese and milk-blended butter shall be sold or consigned as margarine, or margarine cheese or, in the case of milk-blended butter, by a name approved by the M. of A. and F.

(*a*) The word " Margarine " must be branded or durably marked on the top, bottom and sides of every package in printed capital letters not less than three-quarters of an inch square, the brand or mark being on the packet itself and not solely on a label, ticket or other thing attached thereto.

(*b*) There shall be attached to every parcel of margarine exposed for sale by retail, in such manner as to be clearly visible to the purchaser, a label marked " Margarine " in printed capital letters not less than one and a half inches square.

(*c*) When sold by retail, save in a package duly branded or durably marked as aforesaid, margarine shall in every case be delivered to the purchaser in a paper wrapper and the word " Margarine " shall be printed

on the outside of such wrapper (or if more wrappers than one are used, on the outside of the outer wrapper) in capital block letters not less than half an inch long without other printed matter except a statement of the weight where required by law.

(*d*) Margarine shall not be described on any wrapper, package, label, &c., by any name other than either " Margarine " or a name combining the word " Margarine " with a fancy or other descriptive name approved by the M. of A. and F. and printed in type not larger than, and in the same colour as, the word " Margarine ".

The requirements of paragraphs (*a*), (*b*) and (*c*) apply to margarine cheese with the substitution of " Margarine Cheese " for " Margarine ". Provided that where margarine cheese is sold or dealt in otherwise than by retail it shall be sufficient compliance with the requirements if it is itself conspicuously branded with the words " Margarine Cheese ".

The requirements of paragraphs (*a*), (*b*) and (*c*) apply to milk-blended butter with the substitution of a name approved by the M. of A. and F. for the word " Margarine ", save that there shall, in addition to the approved name, be printed on the outside of the wrapper referred to in paragraph (*c*) in such manner as the M. of A. and F. may approve, such description of the article setting out the percentage of moisture or water contained therein as may be approved by the Minister.

Any substances purporting to be butter or cheese which are exposed for sale and not marked in the manner in which margarine, margarine cheese or milk-blended butter is required to be marked under this Act shall be presumed to be exposed for sale as butter or cheese as the case may be.

It is not lawful to manufacture, sell or expose for sale any margarine the fat of which contains more than 10 per cent of fat derived from milk.

SEC. 7. REGULATIONS.—The M. of A. and F. in England and the Board of Agriculture in Scotland may make regulations for determining what deficiency in, or addition (including water) to, milk, cream, butter or cheese, or what proportion of milk solid other than fat in butter or milk-blended butter shall raise the presumption that they are not genuine or are injurious to health.

The M. of H. in England and the D. of H. (Scotland) may make regulations prohibiting or limiting the use of preservatives in the manufacture for sale of butter, margarine and milk-blended butter. It is an offence to sell or expose for sale any of the above articles which contain a prohibited preservative or one in excess of the limit allowed.

SEC. 8. REGISTRATION OF FACTORIES AND WHOLESALE PREMISES.—The following premises must be registered with the F.D.A., namely: (*a*) factories of margarine, margarine cheese, or milk-blended butter; (*b*) premises of a wholesale dealer in these articles; (*c*) butter factories (where butter is blended, reworked or otherwise treated but not so as to cease to be butter). All registrations must be notified by the F.D.A. to the M. of A. and F.

No butter factory may form part of, or communicate, except by a public street or road with any of the registered premises set out in (*a*) and (*b*) above.

SEC. 9.—Every occupier of the premises set out in (*a*) and (*b*) above must keep an accurate register of the quantity and destination of each consignment of margarine, margarine cheese, or milk-blended butter sent out from the factory or place of business and the register shall be open to inspection by an officer of the M. of A. and F.

SEC. 10.—If any article intended to adulterate butter, or any fat or oil capable of being so used, is found in any butter factory, it shall be deemed to be intended to be so used, unless the contrary is proved.

SEC. 11. MOISTURE IN BUTTER AND MARGARINE.—No butter in a butter factory or margarine in a margarine factory when prepared for sale or consignment, may

contain more than 16 per cent of water, and, if excess is found the occupier of the factory or consignor, as the case may be, shall be guilty of an offence unless he proves that the butter or margarine was not made, blended, or reworked or treated in the factory.

No milk-blended butter manufactured, sold or exposed for sale, may contain more than 24 per cent of water.

Sec. 12. Importation.—It is an offence to import into the United Kingdom any of the following articles: (*a*) margarine or margarine-cheese, except in packages conspicuously marked " Margarine " or " Margarine Cheese ", (*b*) adulterated or impoverished milk or cream, except in packages or cans conspicuously marked with a name or description indicating that the milk or cream has been so treated; (*c*) condensed separated or skimmed milk, except in tins or other receptacles which bear a label whereon the words " Machine-skimmed Milk " or " Skimmed Milk ", as the case may require, are printed in large and legible type; (*d*) any adulterated or impoverished article of food to which His Majesty may by Order in Council direct that this section shall be applied, unless the same be imported in packages or receptacles conspicuously marked with a name or description indicating that the article has been so treated; (*e*) butter containing more than 16 per cent of water; (*f*) margarine containing more than 16 per cent of water, or more than 10 per cent of fat derived from milk; (*g*) milk-blended butter containing more than 24 per cent of water; (*h*) milk-blended butter, except in packages conspicuously marked with such name as may be approved by the M. of A. and F. for the purpose.

Prosecutions for offences under this section are undertaken by the Commissioners of Customs and Excise.

3.—Administration

Sec. 13.—The L.A.s charged with the execution of the Act are known as " Food and Drugs Authorities ", namely: (1) In London, the Common Council of the City and the Metropolitan Borough Councils.

(2) Outside London, County and County Borough Councils and the Councils of certain other Boroughs. In addition to the F.D.A.s, all S.A.s are empowered, at their discretion, to take samples under the Act, and, where necessary, to institute proceedings thereunder.

In Scotland the Act is administered by County Councils and the Town Councils of large Burghs.

Sec. 14.—Every F.D.A. must put its powers into force and direct its officers to procure samples for analysis, &c.

Sec. 15. Public Analyst.—Every F.D.A. must appoint an analyst, whose appointment and removal are subject to the approval of the M. of H. or D. of H. (Scotland).

Sec. 16. Sampling Officer.—Samples of food or drugs for the purpose of analysis may be taken by a M.O.H., S.I., Inspector of Weights and Measures, Inspector of a Market, or Police Constable. Such officers are known as " Sampling Officers " (S.O.).

A S.O. may take samples in course of delivery, but only at the request or with the consent of the purchaser or consignee, except in the case of milk.

A S.O. may, without going through the form of purchase, take for analysis samples of butter or cheese, or substances purporting to be butter or cheese, which are exposed for sale and are not marked in the manner required for margarine, margarine cheese, or milk-blended butter.

An O.C. and any S.O. (except an Inspector of a Market), if he considers that margarine, margarine cheese, or milk-blended butter is being conveyed by public

conveyance contrary to the provisions of the Act, may examine and take samples for analysis.

If any S.O. applies to purchase any article of food or drug exposed for sale and tenders the price for the quantity required for analysis, and the person exposing, or having for sale, the article refuses to sell or to allow the S.O. to take such quantity for analysis, he shall be guilty of an offence and liable to a fine of £10, provided that, where the article of food or drug is exposed for sale in an unopened tin or package duly labelled, no person shall be required to sell it except in the unopened condition.

SEC. 17. ANALYSIS OF SAMPLES.—If a S.O. suspects a sample, or the article from which the sample is taken, to have been sold contrary to any provision of the Act, he shall submit it to be analysed by the Public Analyst. Any purchaser of an article of food or of a drug is entitled to have it analysed by the Public Analyst on payment of a fee, and to obtain a certificate specifying the result.

SEC. 18. DIVISION OF SAMPLES.—The person purchasing a sample of any article with the intention of submitting it to analysis shall, after the purchase has been completed, forthwith notify to the seller or his agent who sold the sample his intention to have it analysed by the public analyst, and shall then and there divide the sample into three parts, each part to be marked and sealed or fastened up in such manner as its nature will permit, and shall (*a*) if required to do so deliver one part to the seller or his agent; (*b*) retain one part for future comparison; (*c*) if he thinks fit to have an analysis made submit one part to the analyst.

In the case of a sample taken of milk in course of delivery, or of margarine, margarine cheese, or milk-blended butter forwarded by a public conveyance, the person taking the sample shall, if the name and address of the consignor appear on the can or package containing the article sampled, forward to him by registered parcel or otherwise a portion of the sample marked, and sealed, or fastened up.

SEC. 19.—The M. of H. in England and the D. of H. (Scotland) in matters affecting the general interests of the consumer, and the M. of A. and F. in matters affecting the general interests of agriculture, may direct an officer to procure samples and such officer shall have all the powers and duties of a S.O. The sample in this case is divided into four parts: three are to be disposed of as above, and the fourth sent to the Minister or Department as the case may be.

The result of the analysis must be notified to the F.D.A. and they shall take such action as if they themselves had caused the sample to be taken.

SEC. 20.—The Commissioners of Customs and Excise may take samples of imported food to enforce the restrictions on such articles. These samples must be divided into not less than three parts, one of which must be sent to the importer, one to the Government Chemist, while the third is retained for comparison. If the Government Chemist reports that a sample is margarine, or milk-blended butter, the importer must be notified.

SEC. 21. SPECIAL PROVISIONS AS TO SAMPLING OF MILK.—The provisions of the Act relating to the taking of samples and proceedings in connexion therewith, shall, in relation to milk, have effect subject to the provisions contained in the Second Schedule.

The expression " purveyor of milk " includes a seller of milk whether wholesale or by retail.

SECOND SCHEDULE

Special Provisions as to Milk

(1) Where a sample of milk is procured from a purveyor of milk, he shall, on being required to do so by the person by whom or on whose behalf the sample was taken, state the name and address of the seller or consignor from whom he received the milk.

(2) The L.A. in whose district the sample was taken may take or cause to be taken one or more samples of milk in course of transit or delivery from such seller or consignor.

Within sixty hours after the sample of milk was procured from the purveyor he may serve on the L.A. a notice stating the name and address of the seller from whom he received the milk and the time and place of delivery to the purveyor by the seller or consignor of milk from a corresponding milking, and requesting them to take immediate steps to procure, as soon as practicable, a sample of milk in the course of transit or delivery from the seller or consignor to the purveyor, unless a sample has been so taken since the sample was procured from the purveyor, or within twenty-four hours prior to the sample being procured from the purveyor:

Provided that the purveyor shall not have any such right to require that such a sample shall be taken in cases where the milk from which the sample procured from the purveyor was taken was a mixture of milk obtained by the purveyor from more than one seller or consignor.

If a purveyor has served on the L.A. such a notice as aforesaid, and the L.A. have not procured a sample of milk from the seller or consignor in accordance with the foregoing provisions, no proceedings under this Act shall be taken against the purveyor in respect of the sample of milk procured from him.

(3) Any sample of milk so taken in the course of transit or delivery shall be submitted for analysis to the analyst to whom the sample procured from the purveyor is or was submitted.

(4) If proceedings are taken against the purveyor of milk, a copy of the certificate of the result of the analysis of every sample so taken in the course of transit or delivery shall be furnished to the purveyor, and every such certificate shall, subject to the provisions of section twenty-eight of this Act, be sufficient evidence of the facts stated therein, and shall be admissible as evidence on any question whether the milk sold by the purveyor was sold in the same state as he purchased it.

(5) The L.A. of the district in which the first-mentioned sample was taken, may instead of, or in addition to, taking proceedings against the purveyor of milk, take proceedings against the seller or consignor.

(6) If a sample of milk of cows in any dairy is taken in course of transit or delivery from that dairy, the owner of the cows may, within sixty hours after the sample of milk was procured, serve on the L.A. a notice requesting them to take immediate steps to procure as soon as practicable a sample of milk from a corresponding milking of the cows, and the foregoing provisions shall apply accordingly:

Provided that the person taking the sample shall be empowered to take any such steps at the dairy as may be necessary to satisfy him that the sample is a fair sample of the milk of the cows when properly and fully milked.

(7) For the purposes of this Schedule expressions have the same meaning as in the Milk and Dairies (Consolidation) Act, 1915.

Scotland.—The above provisions do not apply to Scotland, but in lieu thereof the following shall have effect: Every person who, himself or by his servant, in any highway or place of public resort sells milk or cream from a vehicle or from a can or other receptacle shall have conspicuously inscribed on the vehicle or recep-

tacle his name and address, and in default shall be guilty of an offence and liable to a fine not exceeding £2.

Sec. 22. Inspection of Factories.—Any officer of the M. of A. and F. or the M. of H. in England and of the Board of Agriculture or Department of Health in Scotland has the right to enter premises registered under the Act, inspect processes and take samples. Any S.O. of a F.D.A., if specially authorized, has the same right as regards a butter factory.

Sec. 24.—It is an offence to obstruct or bribe, &c., an officer in the discharge of his duties.

4.—Legal Proceedings

Sec. 27.—In England proceedings may be taken before a petty sessional court: in Scotland in the sheriff court, a stipendiary magistrates' court of a burgh or police court.

No prosecution may be instituted after the expiration of twenty-eight days from the time of purchase of a sample.

An employee or other person may be prosecuted for an offence instead of the employer if the latter can satisfy the court that the offence was committed without his knowledge and that he had used due diligence to enforce the execution of Part II of the Act.

Sec. 28. Evidence.—The Public Analyst's certificate is sufficient evidence of the facts stated therein unless he is required as a witness, and the same applies to the certificate of a Government Chemist in respect to imported food.

In any proceedings under this Act the part of the sample retained by the person who procured it shall be produced at the hearing.

Sec. 29. Warranty.—The defendant shall be discharged from the prosecution if he satisfies the court that in the case of margarine, margarine cheese, or milk-blended butter he purchased the article with a written warranty, had no reason to believe that it was other than as described and sold it in the same state as when he purchased it, and in the case of any other article that he had purchased it as being the same in nature, substance, and quality as the purchaser had demanded, with a written warranty to that effect, that he had no reason to believe that it was other than described and that he sold it in the same state as when he purchased it.[1]

A warranty may only be used as a defence if, within seven days of the service of the summons, notice has been given to the prosecutor, specifying the name and address of the warrantor, who has also been given notice, or where a warranty has been obtained from a person resident outside the United Kingdom if steps have been taken to verify its accuracy.

Sec. 30. False Warranties and Certificates.—Every person who wilfully applies to an article of food, or drug, in any proceedings under this Act, a certificate or warranty given in relation to any other article of food or drug, or who wilfully gives a label with any article of food or drug sold by him which falsely describes the article sold, shall be guilty of an offence.

Every person who, in respect of an article of food or drug sold by him as principal or agent, gives to the purchaser a false warranty in writing, shall be guilty of an offence, unless he proves to the satisfaction of the court that when he gave the warranty he had reason to believe that the statements or descriptions contained therein were true.

[1] In Scotland, where proceedings are taken under the Act in respect of milk, cream, skimmed milk, separated milk, or buttermilk, a warranty or invoice is not available as a defence.

5.—Miscellaneous

Sec. 34. Definitions.

"Food" includes every article used for food or drink by man, other than drugs or water, and any article which ordinarily enters into or is used in the composition or preparation of human food, and also includes flavouring matters and condiments.

"Drug" includes medicine for internal or external use.

"Butter" means the substance usually known as butter, made exclusively from milk or cream, or both, with or without salt or other preservative, and with or without the addition of colouring matter.

"Cheese" means the substance usually known as cheese, containing no fat derived otherwise than from milk.

"Margarine" means any article of food, whether mixed with butter or not, which resembles butter and is not milk-blended butter.

"Margarine cheese" means any substance, whether compound or otherwise, which is prepared in imitation of cheese, and which contains fat not derived from milk.

"Milk-blended butter" means any mixture produced by mixing or blending butter with milk or cream other than condensed milk or cream.

"Importer" includes any person who, whether as owner, consignor or consignee, agent or broker, is in possession of, or in anywise entitled to the custody or control of, the article.

Suggestions relating to Collection and Disposal of Samples[1]

The quantity of any article purchased should be sufficient to enable a satisfactory analysis to be made of each of the three portions into which the sample is divided, but should not be so large as to attract special attention. In any case of doubt the Public Analyst should be consulted as to the quantity required.

The three portions should be made as nearly equal as possible.

In the case of such an article as milk care should be taken to secure an even distribution of the constituent parts of the sample before it is divided. Where milk is sold in bottles it may be useful for this purpose to pour the milk into a larger vessel, and then return a small quantity to rinse out the bottle before the final mixing.

The bottles used for liquids should have a narrow neck and should be filled as nearly as possible, since if the samples are shaken in transit the use of bottles much too large for the contents may result in a separation of some of the constituents of the liquids.

Such bottles should be closed with new and sound cork stoppers fitting so tightly as to secure the contents with no aid from the wax used for sealing. The sealing should be carried out in such a way as to prevent any attempt to remove the cork. It is, therefore, recommended that the cork should be slit down to a quarter of its length and string drawn through and securely fastened round the neck, the ends afterwards being carried to the top of the cork and sealed thereon.

Samples of solid fatty substances such as butter, margarine, lard or dried milk, in which it is important that the proportions of fat and water should be accurately estimated, should be placed without paper (since paper acts as an absorbent) in a dry, wide-mouthed, stoppered bottle, or earthenware jar. It is an advantage to use a screw-capped bottle, provided with a cork-lined metal lid, having a mouth

[1] Taken from Ministry of Health Memo. 36, Foods.

as nearly as possible of the full width of the bottle. The sample can be placed in such a bottle without pressure, and can be easily removed by the analyst.

All bottles should have rounded sides in order to give security to the samples in transit.

The labels used should be printed in triplicate, and bear serial numbers so as to avoid any confusion. The vendor should be given an opportunity of verifying the identity of the labels used for the three portions of the samples.

In all cases where a screw-capped bottle or any receptacle which cannot conveniently be sealed is used it should be labelled with the necessary particulars, and enclosed in an envelope of stout paper secured at the ends with the Official seal. The serial number and other particulars should be placed both on the bottle and on the envelope.

Where cows are milked under the supervision of the sampling officer and a sample of the milk is taken immediately afterwards, the part submitted to the Public Analyst should be marked " Appeal to Cow Sample ", or in some other distinctive manner to indicate the circumstances in which it was taken.

When a sample of a prescribed medicine is taken, the height of the contents in the bottle supplied by the vendor should be marked in his presence prior to the division of the sample. The bottle so marked should be submitted to the analyst in order to enable him to determine the total quantity of medicine supplied.

The retained portion of any perishable article should be kept at an equable and cool temperature in a dark place.

CHAPTER V

Milk

ENGLAND AND WALES (including London): Milk and Dairies (Consolidation) Act, 1915—Milk and Dairies Order, 1926—The Milk (Special Designations) Order, 1923. (See p. 355.)—Public Health (Prevention of Tuberculosis) Regulations, 1925—Public Health Acts Amendment Act, 1907; Sec. 53. (See also Public Health (Imported Milk) Regulations, 1926, p. 461.)

ENGLAND AND WALES (excluding London): Public Health Act, 1875; Secs. 49 and 50—Infectious Disease (Prevention) Act, 1890 (Adoptive)—Public Health Acts Amendment Act, 1907; Secs. 52 and 54. (See also Public Health Act, 1925; Sec. 72, p. 420.)

LONDON: Public Health (London) Act, 1891; Secs. 20, 35, 36, 69, and 71—London County Council (General Powers) Act, 1904; Sec. 27—London County Council (General Powers) Act, 1907; Secs. 24, 29, 30, and 35—London County Council (General Powers) Act, 1908; Secs. 5 and 8.

SCOTLAND: The Cattle Sheds in Burghs (Scotland) Act, 1866—Milk and Dairies (Scotland) Act, 1914—Milk and Dairies (Scotland) Order, 1925—The Milk (Special Designations) Order (Scotland), 1930. (See p. 364.)

GREAT BRITAIN: Milk and Dairies (Amendment) Act, 1922—Tuberculosis Orders, 1925–1931. (See also Food and Drugs (Adulteration) Act, 1928, p. 476, and Sale of Milk Regulations, 1901 and 1912, p. 351.)

England and Wales (including London)

Milk and Dairies (Consolidation) Act, 1915

The Act came into operation on the 1st September, 1925. It repealed the Contagious Diseases (Animals) Acts and the Orders made thereunder.

INTERPRETATION. (SEC. 19.)

(1) " Milk " includes cream, skimmed milk, and separated milk.

" Dairy " includes any farm, cowshed, milk store, milk shop, or other place from which milk is supplied on, or for, sale or in which milk is kept or used for purposes of sale or manufacture into butter, cheese, dried milk or condensed milk for sale, and, in the case of a purveyor of milk who does not occupy any premises for the sale of milk, includes the place where he keeps

the vessels used by him for the sale of milk, but does not include a shop from which milk is not supplied otherwise than in the properly closed and unopened receptacles in which it was delivered to the shop, or a shop or other place in which milk is sold for consumption on the premises only.

"Dairyman" includes any occupier of a dairy, any cowkeeper, or any purveyor of milk.

"Purveyor of Milk" includes a seller of milk, whether wholesale or by retail.

Where milk is sold or exposed or kept for sale it shall be presumed to be sold or exposed or kept for sale for human consumption or for use in the manufacture of products for human consumption unless the contrary is proved. (Sec. 19 (2).)

Where milk is kept in any dairy, or in the custody or possession of any dairyman, it is to be presumed to be kept for the purposes of sale, or manufacture for sale, unless the contrary is proved. (Sec. 19 (3).)

Orders

Sec. 1.—The M. of H. is authorized to make general or special orders (Milk and Dairies Order) for specified purposes. The Milk and Dairies Order, 1926, was made under this provision.

An Order with respect to the inspection of cattle may require any cow to be milked from any particular teat in the presence of the inspecting officer who may take a separate sample from any teat.

Power to stop Supply of Milk likely to cause Tuberculosis

Sec. 3.—The M.O.H. of a county or county borough (and, if the M. of H. so orders, of any non-county borough which is a L.A. under the Diseases of Animals Acts) if of opinion that tuberculosis is caused, or is likely to be caused, by the consumption of milk from any dairy in his district may put in force the procedure for stopping the supply of milk set out in the first schedule to the Act, namely:

(*a*) He reports matter to his Council enclosing any bacteriological or veterinary reports.

(*b*) Council may serve on the dairyman notice to appear before them (or explain in writing) within such time not less than forty-eight hours after service of the notice, to show cause why an order should not be made prohibiting him either absolutely, or unless such conditions as may be prescribed in the Order are complied with, from supplying for human consumption, or using or supplying for use in the manufacture of products for human consumption, any milk from the dairy, or from any particular cow or cows therein until the order has been withdrawn. The notice must be accompanied by any reports on the dairy. If the dairyman fails to show cause why the Order should not be made the Council shall make the Order (specifying the grounds on which it is made) and shall serve a copy on the dairyman and notify the facts to the M. of H. and the M. of A. and F. Any such order shall forthwith be withdrawn, and notice of withdrawal served on the dairyman as soon as may be after the Council or their M.O.H. is satisfied that the milk supplied from the dairy is not likely to cause disease.

(*c*) If authorized to do so the M.O.H. may withdraw the Order.

(*d*) Dairyman may appeal to court of summary jurisdiction, but, pending the hearing, the Order will remain in force unless previously withdrawn.

(e) Unless the Order has been made in consequence of his own default or neglect, the dairyman is entitled to full compensation for any loss or damage which he may have sustained.

Obligation to inspect Dairies in Certain Cases

Sec. 4.—If the M.O.H. of any L.A. has reason to suspect that tuberculosis is, or is likely to be, caused by any milk sold in his own district, he shall endeavour to ascertain the source of supply and give notice of any facts ascertained to the M.O.H. of the county or county borough (or of the non-county borough as in Sec. 3 above) in which the cows from which the milk is obtained are kept. On receipt of such notice the M.O.H. of the area in question shall cause the cattle in the dairy to be inspected. (The M.O.H. who made complaint must have notice of such inspection and may be present along with a V.S. appointed by his S.A., and the dairyman may also if he chooses have a V.S. present.) The results of such inspection, with copies of bacteriological and veterinary reports, must be sent to the M.O.H. who gave notice, together with an account of any action taken.

Prohibition of Sale of Tuberculous Milk

Sec. 5 and Second Schedule.—It is an offence under the Act to sell, offer, or expose for sale, or use in the manufacture of products for human consumption, milk from a cow which has given tuberculous milk, or is suffering from tuberculosis of the udder, from emaciation due to tuberculosis, from acute inflammation of the udder, acute mastitis, or actinomycosis of the udder, anthrax, foot-and-mouth disease, or suppuration of the udder, or from any other disease affecting cows which by a Milk and Dairies Order is declared to be a disease [1] for the purposes of this section, if it is proved that the seller knew, or by the exercise of ordinary care could have ascertained, that the cow had given tuberculous milk or was suffering from any such disease.

Milk Sampling

Sec. 8.—An Inspector of the M. of H. or the M.O.H. of a L.A. (or anyone exhibiting an authority in writing from one of these officers or from the L.A.) may take samples of milk for examination at any time before the milk is delivered to the consumer. The M.O.H., or a person authorized by him or by the L.A., can take samples only in his own area. The result of analysis or bacteriological or other examination of a sample of milk taken under this Act is not admissible as evidence in proceedings under the Act or the Food and Drugs (Adn.) Act, 1928, unless the sample has been divided into parts in accordance with the provisions of the Act of 1928. No proceedings may be taken against any person unless the milk was in his control or custody at the time of sampling or was contained in a churn sealed in accordance with a Milk and Dairies Order. Unless the defendant desires the witness to be called, a certificate from the officer who took the sample that he complied with all the provisions of the section as to the manner in which samples are to be dealt with is to be taken as sufficient evidence of compliance.

If milk is being sold in a district from a dairy situated outside that district the M.O.H. may by notice in writing require the M.O.H. or other authorized officer of the other L.A. (being an authority for the purposes of the Food and Drugs (Adulteration) Act, 1928, to take samples of the milk at that dairy, or in course of transit

[1] Art. II of the Milk and Dairies Order, 1926, provides that the following shall be diseases for the purposes of Sec. 5 of the Act. Any comatose condition, any septic condition of the uterus, and any infection of the udder or teats which is likely to cause disease.

from that dairy to his own area. Upon receipt of such notice it shall be the duty of the M.O.H. of the other authority to take samples and to forward for analysis or bacteriological examination to the officer who gave the notice a part of any sample so taken. The authority requiring the samples to be taken shall be liable to defray any reasonable expenses incurred, the amount whereof shall, in default of agreement, be settled by M. of H. Court proceedings under the Food and Drugs (Adulteration) Act, 1928, may be taken either in the district where the sample was taken or in that of the officer who gave the notice.

Miscellaneous Provisions

Sec. 6.—Vehicles or vessels from which milk is sold in the streets must be clearly marked with the name and address of the vendor.

Sec. 7.—Every tin or other receptacle containing condensed, separated, or skimmed milk must bear a label clearly visible to the purchaser on which the words " Machine-skimmed Milk " or " Skimmed Milk ", as the case may require, are printed in large and legible type.

Sec. 10.—A L.A. may, and when required by the M. of H. shall, appoint or combine with another L.A. in appointing one or more veterinary inspectors. Any L.A. may, and when required by the M. of H. shall, provide or arrange for the provision of such facilities for bacteriological or other examination of milk as may be approved by the M. of H.

Sec. 15 (4).—Any inspection of cattle made in pursuance of the Act, or any Milk and Dairies Order, shall be carried out by a V.I. or other properly qualified V.S.

Milk and Dairies Order, 1926

Extract from Ministry of Health Circular 711 issued in 1926 along with the Order.

The Order revokes the Dairies, Cowsheds, and Milkshops Orders of 1885, 1886, and 1899, so far as they relate to England and Wales, and all Regulations made thereunder by L.A.s. The main provisions of those Orders and Regulations are replaced in the present Order by provisions similar in general purpose but modified in accordance with the development of modern hygienic knowledge so as to lay greater stress on cleanliness in all operations connected with the production and handling of milk (including the care of the cow) than upon the structure of buildings.

The most important of the new provisions of the Order are those relating to the health and inspection of cattle, and to the handling, conveyance and distribution of milk.

The former provisions are contained in Part IV of the Order and are supplementary to the sections of the Act (Secs. 3, 4 and 5), which involve the inspection of cattle, and they will accordingly be administered by the Authorities upon whom is laid the duty of enforcing those sections, i.e. the Councils of Counties and County Boroughs. In connexion with the general arrangements for the administration of the Act and the Tuberculosis Order the Minister desires to remind L.A.s of the convenience and economy of having the same V.S.s available for both purposes, as mentioned by the M. of A. and F. in their Circular of the 15th July, 1925.

The remainder of the Order is enforceable by S.A.s. In connexion with the administration of Part VIII (relating to the conveyance and distribution of milk) it may be observed that the officers of C.C.s in the exercise of their duties under the Sale of Food and Drugs Acts will have opportunities for observing the conditions under which milk is consigned by rail (including the condition and marking

of churns), and it is suggested that, where they have reason to suspect any contravention of the provisions of the Order, they should notify the responsible S.A. Except with regard to registration, specific provisions have not been inserted in the Order for the mutual exchange of assistance and information between C.C.s and S.A.s, but the Minister feels sure that all Authorities and their officers will realize the importance of co-operation in the administration of the Order without any specific duty in this respect being imposed on them.

Registration under the Order

Extract from Ministry of Health Circular 757, dated 20th January, 1927.

A number of the questions which have been raised relate in terms to the liability of the farmer himself to registration. The provisions of the Order in this respect differ somewhat from those of the Dairies, Cowsheds and Milkshops Order of 1885. The exemptions contained in the earlier Order for persons who carry on the trade of cowkeeper or dairyman for the purpose only of making and selling butter or cheese and for persons who sell milk of their own cows in small quantities to their workmen or neighbours for their accommodation, have been omitted, and the new Order, following the terms of Sec. 1 (1) (a) of the Milk and Dairies (Consolidation) Act, 1915, provides for the registration of *all* persons *carrying on the trade* of cowkeeper or dairyman. Provision is also made for the registration of *all dairies*. Under the Act a " dairy " includes, inter alia, all farms from which milk is supplied on or for sale, whether or not the extent of such sale amounts to the carrying on of a trade.

The sale of milk which renders the *dairy premises* subject to registration would not necessarily constitute the carrying on of a trade involving the registration of the *dairyman*, and the question whether any particular person is carrying on a trade is one of fact which can only be settled on a consideration of the circumstances. In reply, however, to a request from a L.A. for some general ruling, the Minister, while pointing out that he has no jurisdiction which would enable him to give a decision, has suggested that in ordinary cases, where a person keeps a number of cows, *not exceeding the number required for the purposes of his own household*, and sells any milk, butter, &c., which may from time to time be produced surplus to those requirements, he might properly be regarded as not carrying on the trade of dairyman and, therefore, as not being subject to registration under the Order.

A somewhat wider interpretation than they were intended to bear appears to have been placed in some quarters upon the terms of the Minister's letter. The relevant consideration appears to the Minister to be whether the farmer in fact keeps more cows than would normally be required for the needs of his household. If so, there appears to be prima facie ground for assuming that he is " carrying on the trade of a dairyman ".

Application of the Order

The question of the registration of the farmer is, however, in itself a matter of minor importance, since the Order, following the terms of Sec. 1 (I) (b) of the Act of 1915, requires also the registration of *all* dairies, including all farms from which milk is supplied on or for sale. Further, the general requirements of the Order which impose obligations on cowkeepers and prescribe the conditions of cowsheds and other registered premises, apply to *all places at which milk is produced for sale* whether in large or in small quantities.

Administration

The general object of the Order is the protection of the community by the application of the principles of sanitation and cleanliness which it incorporates. In many respects the standard to be attained in these matters is not, and could not with advantage be, precisely defined in the Order, but is left to a large extent to the discretion of the L.A., subject, in any case of dispute, to the ruling of the Courts. The Minister has no doubt that L.A.s will use their discretion reasonably in administering the Order, both in relation to farms on which milk is being produced on a commercial scale and in other cases, regard being had particularly to the importance of the use of cleanly methods. For example, the terms of Article 13 should not in the Minister's view be construed as involving the laying of a piped supply of water from any public source where this is not readily available and should ordinarily be satisfied by arrangements of the same character as would be made in the particular case for domestic purposes.

In cases where a few cows only are kept primarily to meet the needs of the household, but a small quantity of the milk produced is sold to employees and neighbours, the general principles of sanitation and cleanliness of method which the Order incorporates must be observed if the consumers are to enjoy the same measure of protection as the Order affords to other sections of the community. But it will no doubt often be found in such cases that the objects of the Act and Order can in practice be secured and that the general requirements of the Order as to condition of premises can be satisfied by inexpensive arrangements of a simpler character than might be regarded as reasonably necessary in the case of larger establishments. In any case of doubt as to the adequacy of premises the hygienic quality of the milk produced as disclosed by the examination of samples should give some guidance as to the action necessary.

In many areas the S.A. may find that the task of administering the Order will be sensibly lightened by co-operation with the Agricultural Education Authority for the County, whose educational work, so far as it deals with the production of clean milk, is designed to secure substantially the same objects as the Order. Although the responsibility for the administration of the Order must rest entirely with the S.A., it would be to the general advantage that the Officers of the two Authorities should work in consultation with each other.

The Minister is informed that notices have been served by some L.A.s requiring alterations to cowsheds to be made forthwith. I am, therefore, to call the attention of the Council to Article 1 of the Order, which provides that eighteen months' notice must be given of any alterations required for the purposes of Articles 12 (1), 13 (1) and 25, and that in the case of Article 25 no such notice shall be given before the 1st April, 1928.

Clean Milk Courses for Sanitary Inspectors

Courses of instruction in the essentials of clean milk production are held from time to time at agricultural colleges and other centres under the auspices of the M. of A. and F. The duration of a course is usually about four or five days, but sometimes a course is arranged for one day or half a day each week for a number of weeks. The fee for a course is usually from one to two guineas.

In view of the progress which has been made during the past few years in the knowledge of the conditions governing the production and handling of clean milk, the Minister thinks that courses of this character may often be useful in enabling S.I.s to appreciate the relative importance of the various provisions of the Order, and he is of opinion that a S.A. may legally incur the reasonable expenditure involved by the attendance of an I. at such a course.

The arrangement of these courses at any particular centre is dependent on the requirements of the surrounding area. If a S.I. desires to attend such a course, and there is apparently none readily available to him, he should communicate with the M. of A. and F., who will endeavour to make suitable arrangements.

Registration Procedure

The exact form of register or registers to be kept is left to the decision of L.A.s, except so far as the matter is governed by the provisions of Sec. 2 (3) of the Milk and Dairies (Amendment) Act, 1922, which require separate registration of persons carrying on the trade of retail purveyors. It may, however, be observed that there is no necessity to use separate registers for the registration of persons and of premises.

It will probably be found convenient to enter in a separate division of the register, or otherwise specially to distinguish, premises in which cows are kept, in order that the information to be supplied to C.C.s in pursuance of Article 6 (4) for the purpose of facilitating the inspection of cattle, may be readily extracted.

The following particulars at least should be recorded: (1) Situation or postal address of the premises; (2) (*a*) name of cowkeeper or dairyman; and (*b*) his address, if elsewhere than at (1).

In addition to these particulars, some L.A.s may find it useful to record further information as to the scope of the business carried on (e.g. the approximate number of cows kept or gallons of milk purchased or sold daily, or the possession of a licence to sell graded milk).

It may be added that it is not necessary that new registers should be compiled for the purposes of the new Order if the old registers contained all the requisite particulars, or could easily be adapted and brought up to date. Even where it is found to be convenient to prepare new registers, the old ones could in most cases be used as a basis, any further information required being obtained by means of specific inquiry from the persons already registered. The entry of known particulars in the register should not be delayed pending the receipt of a formal application for registration.

Inspection of Cattle

The Minister's view is that the minimum which could be regarded as satisfying the requirements of Article 8 of the Order would be such inspections as are necessary for the purposes of Secs. 3 and 4 of the Act, and for investigating cases where some definite cause of suspicion exists, such as the discovery of tubercle bacilli in a sample of milk.

It is for each C.C. to decide, according to the experience available in their area, what amount of further inspection is desirable. It was not considered practicable, in view of the varying circumstances of different counties, to require in the Order that C.C.s should undertake the regular periodical inspection of all dairy cattle. Inspection conducted on purely routine lines may not, in all cases, be the best means of attaining the objects of the Act. The Minister is, however, aware that some L.A.s have, in the past, carried out periodical inspections, and have been satisfied that the results were beneficial. Where these conditions exist it is suggested that the C.C. should consider the advisability of continuing the established practice.

The Milk and Dairies Order, 1926, dated 6th July, 1926, made under the Milk and Dairies (Consolidation) Act, 1915

2.—(1) In this Order, unless the contrary intention appears:

" Infectious disease " means dysentery and any infectious disease to which the Infectious Disease (Notification) Act, 1889, applies.

" The Act " means the Milk and Dairies (Consolidation) Act, 1915.

" Cowkeeper " means any person who keeps one or more cows for the purpose of the supply of milk.

" Milk " means milk intended for sale for human consumption or for use in the manufacture of products for sale for human consumption, and includes cream, skimmed milk and separated milk.

" Dairy " (the definition is the same as in the Milk and Dairies (Consolidation) Act, 1915, see p. 480).

" Registered premises " means any building or other premises required to be registered under the provisions of this Order.

3. Part IV of this Order shall be enforced and executed by the council of the county or county borough and the remainder of the Order by the sanitary authority:

Provided that, where the M. of H. has made an Order under subsection (4) of Sec. 3 of the Act with respect to a non-county borough, Part IV of this Order shall be enforced and executed by the council of such borough as if the borough were a county borough.

4. Every cowkeeper and dairyman shall take all practicable steps to make the provisions of this Order known to every person in or about any registered premises in his occupation so far as such provisions impose any duties or restrictions on such person and so far as they relate to the processes carried out by such person.

Part II relates to Revocation of Orders and Regulations.

Part III.—Registration and Notices

6.—(1) Every S.A. shall keep registers of all persons carrying on in their district the trade of cowkeeper or dairyman and of all farms and other premises which are used as dairies.

(2) Subject to the provisions of Sec. 2 of the Milk and Dairies (Amendment) Act, 1922, or of any other statutory enactment, the S.A., on the application of any person proposing to carry on in their district the trade of cowkeeper or dairyman or to use any farm or other premises in the district as a dairy, shall register such person or such premises.

(3) Subject as aforesaid, no person shall carry on the trade of cowkeeper or dairyman or use any premises as a dairy unless he and any such premises are registered in pursuance of this article.

(4) The S.A. shall immediately after the commencement of this Order inform the C.C. of the particulars of registration then in force of cowkeepers and their premises, and they shall as soon as may be inform the C.C. of all alterations made in the registers.

7. Before commencing to use as a cowshed or as a place for the keeping of milk a building not previously used for that purpose the occupier shall give one month's notice in writing to the S.A. of his intention so to do.

Part IV.—Health and Inspection of Cattle

8. Every C.C. and county borough council shall cause to be made such inspections of cattle as may be necessary and proper for the purposes of the Act and of this Order.

9. Where a V.I. gives notice to a cowkeeper of his intention to make an inspection of cattle for the purposes of the Act or of this Order the cowkeeper shall not allow any cow to be removed from the registered premises without the consent of the inspector until the inspection has been made or a period of forty-eight hours has elapsed from the receipt of the notice.

10. A V.I. making the inspection of cattle in pursuance of the Act or of this Order may require any cow to be milked in his presence and may take samples of the milk and may require that the milk from any particular teat shall be kept separate, and he may take separate samples thereof.

11. The following diseases affecting cows, in addition to the diseases specified in Sec. 5 of the Act, shall be diseases for the purposes of that section, namely: Any comatose condition; any septic condition of the uterus; any infection of the udder or teats, which is likely to convey disease:

Provided that, where an officer of a L.A. gives a notice under the section with regard to any of the diseases set out in this article:

(1) The notice shall forthwith be withdrawn as soon as the officer or the authority is satisfied that the cow is no longer in an infective condition; and it shall in any case cease to operate at the expiration of such period not exceeding five days as may be specified therein, but without prejudice to the right of the officer to give a further notice or notices with a like limitation of duration; and

(2) The L.A. shall, if required so to do by the person receiving such notice, afford him an opportunity to appear before them for the purpose of applying for the withdrawal of the notice and shall consider any written representations made by him for the same purpose.

Part V.—General Provisions for securing the Cleanliness of Dairies, etc., and for protecting Milk against Infection and Contamination

12.—(1) Every cowshed and every building used for keeping milk, other than a cold store, shall be provided with a sufficient number of windows or other openings suitably placed and communicating directly with the external air. The windows or permanent openings shall be such as to secure that the building is sufficiently lighted during the hours of daylight and the openings provided for ventilation shall be kept in proper order and so used as to secure that the air in the building is kept in a fresh and wholesome condition.

(2) Every such building in which milking or any other process is carried on during the hours of darkness shall also be provided with such lamps or other means of artificial lighting as will enable any such process to be conducted in a good and proper light.

13.—(1) All registered premises shall be provided with a supply of water suitable and sufficient for the requirements of this Order.

(2) Every receptacle used for the storage or conveyance of water shall be emptied and cleansed from time to time as often as may be necessary to prevent the pollution of the water and to maintain it in a suitable condition for the purpose for which it is required.

(3) The water supply used for the watering of cows shall, as far as reasonably possible, be protected against contamination caused by the drainage of foul water.

14. The following provisions shall apply for the purpose of preventing contamination or infection of milk:

(1) Milk shall not be deposited or kept in any place where it is liable to become contaminated or infected. In particular it shall not be deposited or kept:

(i) in any room used as a kitchen, scullery, living-room or sleeping-room; or

(ii) in any room or part of a building which communicates directly by door, window or otherwise with (*a*) any water-closet, earth-closet, privy, cesspool or receptacle for ashes or other refuse; or (*b*) any room which is used as a sleeping-room or any room which is occupied by a person suffering from an infectious disease, or which, having been so occupied, has not been subsequently properly disinfected; or

(iii) in any room or part of a building in which there is any direct inlet to a drain which is not efficiently trapped:

Provided that the foregoing provisions shall not be deemed to prohibit the deposit or keeping of milk intended for use in the manufacture of butter, cream or cheese in a room used as a kitchen.

(2) Vessels containing milk shall be properly covered or the milk shall be otherwise effectively protected from dust, dirt, flies or other sources of contamination.

(3) No foul or noxious matter or soiled bed or body clothing shall be conveyed through any part of a building used for the keeping or storage of milk.

15. Every person engaged in the milking of cows or the distribution or measuring of milk or otherwise having access to the milk or to the churns or other milk receptacles shall keep his clothing and person in a cleanly condition.

16. A person shall not carry out any process of cooling, bottling, sterilizing or pasteurizing milk or any other process connected with milk, or keep any appliances connected with any such process, in a cowshed or in any place where the milk or appliances would be liable to contamination arising from any cowshed, stable or manure-heap, or otherwise.

17.—(1) Every person having access to the milk or to the churns or other milk receptacles in or about any registered premises, as soon as he becomes aware that any member of his household is suffering from any infectious disease, shall immediately notify the occupier of such premises of the fact and the occupier shall immediately notify the M.O.H. of the district in which the premises are situate unless notification has already been given to that officer.

(2) Where the M.O.H. of any S.D. becomes aware that any such person is suffering from an infectious disease or has recently been in contact with a person so suffering he shall forthwith notify the occupier of such premises of the fact, and where the council of such sanitary district are not the registering authority for the locality in which the premises are situate he shall also notify the M.O.H. of the registering authority.

18.—(1) Where the M.O.H. of a S.D. is in possession of evidence that any person is suffering from infectious disease caused by the consumption of milk supplied within the district from any registered premises or that the milk at any registered premises within the district has been infected with such disease, he may by a notice in writing to the occupier of such premises specifying such evidence require, if the premises are within the district, that no milk from such premises (or, if the notice so provides, no milk received at such premises from any specified source) shall be sold for human consumption or used in the manufacture of pro-

ducts for human consumption, or, if the premises are without the district, that no such milk shall be sold for human consumption within the district.

(2) Any such notice shall operate for such period not exceeding twenty-four hours as may be specified therein from the time of the receipt of the notice, but may be renewed for a further period or periods of twenty-four hours. The notice shall forthwith be withdrawn as soon as the M.O.H. is satisfied that the milk is no longer likely to cause infectious disease.

(3) Where the M.O.H. serves such a notice he shall forthwith report the matter to the S.A., and if the premises are within the district he shall forthwith endeavour to ascertain the causes of the infectious condition of the milk.

(4) Where the milk in respect of which a notice is given under this article is obtained from any registered premises without the district, the M.O.H. shall forthwith send a copy of the notice to the M.O.H. of the S.D. from which the milk is obtained.

(5) No person shall sell milk for human consumption or use milk or sell milk for use in the manufacture of products for human consumption contrary to the terms of a notice given by the M.O.H. under this article.

(6) Where any person sustains any damage or loss by reason of a notice issued under this article he shall be entitled to full compensation from the S.A. in case it shall appear that no infectious disease was in fact caused by the consumption of milk from the premises to whose occupier the notice was addressed or as the case may be that no milk at such premises had been infected with such disease. Any dispute as to the right to or the amount of such compensation shall be settled by arbitration in the same manner as provided by the P.H. Act, 1875, and any sum awarded as compensation shall be recoverable as a civil debt: Provided that if the compensation claimed does not exceed £20 it may at the option of either party instead of being settled as hereinbefore provided be settled by and recoverable before a Court of Summary Jurisdiction.

19.—(1) Where the M.O.H. of the registering authority by reason of such notification or otherwise suspects that any of the persons in or about any registered premises who have access to the milk or to the churns or other milk receptacles is suffering from an infectious disease or has recently been in contact with any person so suffering or is in such a condition that there is a danger of his transmitting an infectious disease he may give notice to the occupier of such premises that he considers it necessary to make an examination of any or all of such persons; and where he gives such notice, the said occupier and every person concerned shall give to the M.O.H. all reasonable facilities for making such examination.

(2) Where from the result of any such examination or otherwise the M.O.H. is of opinion that the employment of any such person is likely to lead to the spread of infectious disease, the M.O.H. may give notice in writing to that effect to the occupier of the registered premises and to the person concerned requiring that, during a period to be specified in such notice, the person to whom the notice relates shall not milk cows or handle vessels used for containing milk or in any way take part in the production, distribution or storage of milk.

(3) A person to whom any such notice relates and any other person who is suffering from an infectious disease or has recently been in contact with a person so suffering shall not milk cows or handle vessels used for containing milk or in any way take part in the production, distribution or storage of milk until the expiry of the period mentioned in the notice or, as the case may be, until all danger of the communication of infectious disease by means of the milk has ceased.

(4) No cowkeeper or dairyman shall allow any person to whom any such notice relates, or any other person who is so suffering or has recently been in contact as aforesaid, to milk cows or handle vessels used for containing milk or in any way to take part in the production, distribution or storage of milk, until the

expiry of the period mentioned in the notice or, as the case may be, until all danger of the communication of infectious disease by means of the milk has ceased.

20. No person shall keep any swine or poultry in any cowshed or room in which cows in milk are kept or milked or in which milk or milk utensils are kept or in any room or shed communicating directly therewith.

21. Every cowkeeper or dairyman shall cause all vessels (including the lids of such vessels) and appliances used or intended to be used by him for containing, measuring or stirring milk, or for any other purpose for which they may be brought into contact with milk, to be kept at all times in a state of thorough cleanliness.

For this purpose:

(i) Every such vessel, lid and appliance shall be thoroughly washed as soon as may be after use, and shall be cleansed and scalded with boiling water or steam before it is used again.

(ii) No oxidizing or preservative agent shall be used in the cleansing of any such vessel or appliance.

(iii) Every such vessel, lid and appliance, when not in use, shall be stored in a clean place and shall be protected from dust and dirt.

(iv) No such vessel or appliance shall be used for containing, measuring or applying any process or treatment to any article other than milk or milk products:

Provided that the requirements set out in paragraphs (i) and (ii) shall not apply to mechanical milkers and similar appliances used in milking which are efficiently cleansed so that all trace of any substance used in the cleansing is removed before they are brought into contact with milk.

Part VI.—Special Provisions applicable to Cowkeepers

22.—(1) Every cowkeeper shall cause every part of the interior of every cowshed in his occupation to be thoroughly cleansed from time to time, as often as may be necessary to secure that such cowshed shall be at all times reasonably clean and sweet.

(2) He shall cause the ceiling or interior of the roof and the walls of every such cowshed to be properly lime-washed or sprayed with lime or otherwise disinfected twice at least in every year, that is to say, once during April or May and once during September or October, and at such other times as may be necessary:

Provided that this requirement shall be deemed to be satisfied as regards any part of such ceiling or walls which is properly painted or varnished or constructed or covered with tiles or other smooth washable material if that part is properly washed from time to time as often as may be necessary to keep it clean.

(3) He shall cause all dung and other offensive matter to be removed from any cowshed in his occupation in which cows are milked at least once in every day.

(4) He shall not cause any dung or offensive matter to be so placed as to render uncleanly the access to any cowshed or milk room.

23. Every cowkeeper shall cause the following precautions to be taken in connexion with the milking of cows, viz.:

(i) The milking shall be carried out in a good and proper light whether in the daytime or in the hours of darkness.

(ii) Before milking is begun, all dirt in or around the flanks, udder and teats of each cow shall be removed, and the udder and teats shall be cleansed by being thoroughly rubbed with a clean damp cloth.

(iii) The hands of the milker shall be thoroughly washed and dried before milking and shall throughout the milking be kept clean, free from contamination and, as far as practicable, dry.

(iv) All milking stools shall be kept thoroughly clean.

(v) As soon as possible after milking, the milk of each cow shall be removed from the cowshed to a suitable milk room or shall be placed in a covered receptacle.

(vi) No dry bedding or other dusty matter shall be moved in the cowshed during the milking or within half an hour before the milking commences, except so far as may be necessary for the removal of dung.

24.—(1) Every cowkeeper shall, without any delay other than that caused by any process of straining or centrifugalization to which it may be subjected, cause the milk to be cooled to a temperature not more than 5 degrees Fahrenheit higher than the temperature of the water supply available for cooling: Providing that this requirement shall not apply—

(i) where the milk is delivered by road without delay to a collecting station provided with adequate facilities for cooling milk to a temperature not exceeding 55 degrees Fahrenheit; or

(ii) where the milk is used for the manufacture of butter, cream, cheese or other milk products at the premises where it is produced or is supplied to some other person for this purpose; or

(iii) where the cowkeeper sells the milk to the consumer and either delivers it at the premises where it is produced or dispatches it at least twice a day on the day of production; or

(iv) where the cowkeeper sells the milk to some other purveyor at the premises where it is produced for delivery to the consumer immediately after milking.

(2) Every person who receives at a collecting station milk which has not previously been cooled shall forthwith cause it to be cooled to a temperature not exceeding 55 degrees Fahrenheit unless he uses it in the preparation or manufacture of butter, cream, cheese or other milk products, and every person who purchases for re-sale milk which has not previously been cooled shall cause it to be cooled forthwith to a temperature not exceeding 55 degrees Fahrenheit unless he uses it as aforesaid or delivers it to the consumer immediately after milking.

25. Every cowkeeper shall cause the floor of every cowshed in his occupation to be constructed of such material and in such manner as to render it practicable to remove all liquid matter which may fall thereon, and he shall cause such cowshed to be provided with channels of rendered concrete or other durable and impervious material so constructed as to prevent as far as reasonably practicable the soiling of the cows and so as to receive all such liquid matter and to convey it to a suitable drain or other place of disposal outside such cowshed.

Part VII.—Special Provisions applicable to Buildings used for the Sale, etc., of Milk

26. The following provisions shall apply to any building or part of a building which is used for the sale of milk or in which milk is kept or used for the purpose of sale or manufacture into butter, cheese, dried milk or condensed milk for sale:

(1) The occupier shall cause the interior and the furniture and fittings therein to be thoroughly cleansed from time to time as often as may be necessary to secure the maintenance of reasonable cleanliness, and in particular the floors shall be thoroughly cleansed with water at least once in every day.

(2) Except in the case of a building or part of a building which is used for the sale of milk by retail the occupier shall cause the floor to be constructed of rendered concrete or other durable and impervious material and to be so sloped as to ensure the removal of all liquid matter which may fall thereon, and to be provided with channels so constructed, sloped and placed as to receive all such liquid matter and to convey it to a suitable drain or other place of disposal outside the building.

Part VIII.—Conveyance and Distribution of Milk, Churns, etc.

27. A person shall not use, or cause to be used, for the reception, measurement, storage or delivery of milk any churn, vessel or other receptacle, the interior surface of which is incapable of being readily cleansed.

28. Every person who purchases milk for the purposes of his trade or business, and empties and returns the churns or other receptacles in which the milk is delivered to him, shall cause all such churns and receptacles, other than bottles, to be thoroughly cleansed and securely closed before they leave his custody or control.

29. Every person shall cause every churn, vessel or other receptacle, other than bottles, in which he dispatches milk by rail or road to comply with the following requirements, viz.:

(1) The name and address of the owner shall be permanently marked on the churn, vessel or other receptacle or on a plate or plates of metal properly soldered or otherwise securely affixed thereto.

(2) The churn, vessel or other receptacle shall be provided with a lid without openings, which shall be so constructed and fitted as effectively to prevent the access to the milk of dirt, dust or rain water or the return to the interior of the receptacle of any milk which may have been splashed above the lid.

30. Every person shall cause every churn, vessel or other receptacle used by him for the conveyance of skimmed or separated milk or for containing such milk at any time when it is exposed for sale to be marked with the words "Skimmed Milk" or "Separated Milk", as the case may require, in large and legible type.

31.—(1) Except in pursuance of any statutory authority in that behalf, no person shall open any churn, vessel or other receptacle containing milk or transfer milk from one receptacle to another in any railway van or on any railway station:

Provided that this article shall not be deemed to prohibit the purchaser or his agent when taking delivery of the milk from opening a churn, vessel or other receptacle containing milk or transferring the milk to another receptacle so far as such opening or transfer may be necessary for the purpose of checking and sampling the milk.

(2) Where a person delivers milk in bottles he shall cause every such bottle to be filled and closed on registered premises; and no person shall remove or tamper with the disc or other device used for closing the bottle at any time after it has left such premises and before it is delivered to the consumer.

32. Every person engaged in the conveyance or distribution of milk shall use all practicable precautions for preventing the milk from being unnecessarily exposed to heat and from being contaminated by dirt, dust, rain water or otherwise.

33. The interior of every vehicle used for the conveyance of milk shall be at all times kept clean. No live animal or any article likely to contaminate the milk shall be conveyed in the vehicle at the same time as milk and no vehicle which has been used for the conveyance of offensive matter shall be used for the conveyance of milk until the vehicle has been thoroughly cleansed and purified.

Public Health (Prevention of Tuberculosis) Regulations, 1925

4. No person who is aware that he is suffering from tuberculosis of the respiratory tract shall enter upon any employment or occupation in connexion with a dairy which would involve the milking of cows, the treatment of milk, or the handling of vessels used for containing milk.

5. Notwithstanding anything contained in the Public Health (Tuberculosis) Regulations, 1912, if a L.A., on the report in writing of their M.O.H., are satisfied that a person residing in their district who is engaged in any such employment or occupation as aforesaid is suffering from tuberculosis of the respiratory tract and is in an infectious state, they may by notice in writing signed by the Clerk or the M.O.H. require such person to discontinue his employment or occupation on or before a specified date. There is appeal to a court of summary jurisdiction and compensation may be obtained by a person who sustains damage by reason of the exercise of any of the powers of these regulations in relation to any matter as to which he is not himself in default.

Public Health Acts Amendment Act, 1907

Sec. 53 provides that if the M.O.H. certifies to the L.A. that any person in the district is suffering from infectious disease which the M.O.H. has reason to suspect is attributable to milk supplied within the district, the L.A. may require the dairyman supplying the milk to furnish to the M.O.H. within a reasonable time fixed by them a complete list of all the farms, dairies or places from which his supply of milk is derived or has been derived during the last six weeks, and, if the supply or any part of it is obtained through any other dairyman, may make a similar requisition upon that dairyman. The L.A. shall pay to the dairyman for every list furnished by him the sum of sixpence, and if the list contains not less than twenty-five names, a further sum of sixpence for every twenty-five names contained in the list.

" Infectious disease " means any infectious disease to which the Infectious Disease (Notification) Act, 1889, for the time being applies within the district of the L.A. (i.e. small-pox, cholera, diphtheria, membranous croup, erysipelas, the disease known as scarlatina or scarlet fever, and the fevers known by any of the following names, typhus, typhoid, enteric, relapsing, continued or puerperal, and includes as respects any particular district any infectious disease to which the Act has been applied by the L.A. of the district in manner provided by the Act).

(This section is applied to London by Sec. 20 (1) of the Milk and Dairies (Consolidation) Act, 1915. It extends to other districts when declared to be in force by order of the M. of H. (or L.G.B.).)

England and Wales (excluding London)

Public Health Act, 1875

Sec. 49 authorizes a S.I. to give notice requiring the removal of any accumulation of manure, dung, soil or filth or other offensive or noxious matter. If the notice is not complied with within 24 hours after service the manure, &c., shall be vested in and be sold or disposed of by the L.A., the proceeds being applied in payment of expenses and the surplus (if any) being paid on demand to the owner of the matter removed. If the expenses exceed the proceeds the deficit may be recovered by the L.A. from the person concerned.

SEC. 50 provides that notice may be given by a L.A. for the periodical removal of manure or other refuse matter from mews, stables or other premises. Refusal to comply with such a notice is subject to a penalty.

(These sections are in force in all urban districts and in rural districts by order of the M. of H. (or L.G.B.).)

Infectious Disease (Prevention) Act, 1890

This is an adoptive Act, and has been widely adopted both by urban and rural district councils.

SEC. 4 provides that if the M.O.H. is in possession of evidence that any person in the district is suffering from infectious disease attributable to milk supplied within the district from any dairy situate within or without the district, or that the consumption of milk from such dairy is likely to cause infectious disease to any person residing in the district, he shall if authorized by an order of a justice having jurisdiction in the place where such dairy is situate, have power to inspect such dairy, and if accompanied by a V.S. may inspect the animals therein. If on such inspection the M.O.H. is of opinion that infectious disease is caused from consumption of the milk supplied therefrom, he shall report thereon to the L.A. The L.A. may thereupon give notice to the dairyman to appear before them to show cause why an order should not be made requiring him not to supply within their district milk from the dairy in question, and if he fails to show such cause, they may make such an order. Notice of the facts shall then be given to the S.A. and C.C. (if any) of the district or county in which the dairy is situate and also to the M. of H. An order made by a L.A. shall be forthwith withdrawn on the L.A. or the M.O.H. being satisfied that the milk supply has been changed or that the cause of the infection has been removed.

(For definition of " infectious disease ", see p. 494.)

Public Health Acts Amendment Act, 1907

SEC. 52 provides that if any person knows that he is suffering from an infectious disease, he shall not engage in any occupation or carry on any trade or business unless he can do so without risk of spreading the infectious disease.

(SEC. 53 (Power to require dairymen to furnish list of sources of supply). See p. 494.)

SEC. 54 requires every dairyman supplying milk within the district of the L.A. from premises within or beyond the district to notify to the M.O.H. all cases of infectious disease among persons engaged in or in connexion with his dairy as soon as he becomes aware or has reason to suspect that such infectious disease exists.

For definition of " infectious disease ", see p. 494.

(The above-mentioned sections extend to any district to which they are applied by order of the M. of H.)

Public Health Act, 1925

(See p. 420 as to provisions of Sec. 72 of this Act.)

London

Public Health (London) Act, 1891

Licensing of Cow-houses

Sec. 20 provides that a person carrying on the business of a dairyman shall not use any premises in London (outside the City) as a cow-house or a place for the keeping of cows without a licence (from the C.C.).

(The Transfer of Powers (London) Order, 1933, which came into operation on the 9th March, 1933, provides for the transfer to the several Metropolitan Borough Councils of the function of licensing cow-houses under Sec. 20 of the Act of 1891.)

Removal of Refuse

Sec. 35 enables the S.I. to serve a notice requiring the removal of any accumulation of manure, dung, soil, filth or other matter (provided it is not the duty of the S.A. to remove same), and if the order is not complied with within 48 hours, the manure, &c., becomes the property of the S.A. and may be removed and disposed of by them. The proceeds (if any) of such disposal shall be applied in payment of expenses incurred by the S.A. and any surplus shall be paid on demand to the former owner of the manure, &c. The expenses of such removal and disposal, so far as not covered by the proceeds, may be recovered by the S.A. from the person concerned.

Sec. 36.—The S.A. may employ scavengers or otherwise arrange for the collection and removal of manure and any other refuse matter from any cow-houses within their district, the occupiers of which consent in writing to such removal.

Notice may be given by a S.A. requiring the periodical removal of manure or other refuse matter from cow-houses. Failure to comply with such a notice is subject to penalty.

Infectious Diseases

Sec. 69.—A person who knows himself to be suffering from a dangerous infectious disease shall not milk any animal and shall not engage in any occupation connected with food or carry on any trade or business in such a manner as to be likely to spread the infectious disease.

(As to the meaning of " dangerous infectious disease ", see Secs. 55 (8) and 58 of the Act. The definition is similar to that in the Infectious Disease (Notification) Act, 1889. See p. 494.)

Sec. 71 relates to the inspection of dairies in cases where milk is suspected to have caused infectious disease, and to the prohibition of supplies of milk from such dairies. (The section is similar in terms to Sec. 4 of the Infectious Disease (Prevention) Act, 1890. See p. 495.)

London County Council (General Powers) Act, 1904

Sec. 27 of this Act empowers a V.S. of the L.C.C. to cause to be removed from any dairy farm or cowshed in the county (elsewhere than in the City of London) any cow which he suspects to be suffering from tuberculosis of the udder. After such removal the Council must agree with the owner the full value of the animal, or if they fail to so agree, the value is to be determined by a valuer appointed by the M. of A. and F. The animal must then be slaughtered and the carcass

examined by a qualified (and if required by the owner) independent V.S. If the V.S. certifies that the animal was not suffering from tuberculosis of the udder, the Council shall pay to the owner as compensation the agreed value of the animal or the sum of £30 (whichever is the less) and a further sum of £1 and shall also pay the cost of the employment of any independent V.S. and valuer. If, however, the animal was suffering from tuberculosis of the udder, the Council shall pay to the owner three-fourths of the agreed value of the animal or the sum of £22, 10*s.* (whichever shall be the less) and shall bear half the cost of the employment of any independent V.S. and valuer, the other half being paid by the owner. The carcass of the animal shall belong to the Council and shall be buried or sold or otherwise disposed of as the Council may direct.

Note.—Compare the provisions of the Tuberculosis Order, 1925. (See p. 502.)

London County Council (General Powers) Act, 1907

SEC. 24 authorizes the M.O.H. of the L.C.C. (or a person acting with his authority) to take within the County samples of milk produced or sold or intended for sale within the County. Metropolitan Borough Councils and the Corporation of the City may be authorized by the L.C.C. to take within their district samples of milk for examination by the L.C.C. Powers of sampling outside the County may be exercised by the M.O.H. (or other authorized person) if an order is obtained from a justice having jurisdiction in the place where the sample is to be taken.

SEC. 29 imposes a penalty on any person who, after he has become aware that any cow in his dairy is suffering from tuberculosis of the udder, permits such cow to be kept in any place along with other cows in milk.

SEC. 30 requires any dairyman supplying milk within the county who has in his dairy any cow affected with or suspected of or exhibiting signs of tuberculosis of the udder to notify the M.O.H. of the L.C.C.

SEC. 35 gives concurrent powers of action to the Corporation of the City of London so far as the City is concerned.

London County Council (General Powers) Act, 1908

SEC. 5 gives power to S.A.s (Metropolitan Borough Councils and the Common Council of the City) to remove from the register of cowkeepers and dairymen, or to refuse to register, persons whose premises are considered to be unsuitable for the sale of milk. An appeal against the S.A.'s decision lies to a court of summary jurisdiction.

Note.—See SEC. 2 of Milk and Dairies (Amendment) Act, 1922, as to refusal to register or removal from the register of retail purveyors of milk.

SEC. 8 relates to sanitary requirements for premises used for sale, &c., of food for human consumption. (See p. 423.)

Scotland

The Cattle Sheds in Burghs (Scotland) Act, 1866

SEC. 3.—The magistrates of royal and of parliamentary burghs shall require all cattle sheds, cow-houses and byres within the burghs to be inspected by an officer appointed by them, and if found to be suitable for the purpose, to be licensed by them for the period of one year. The magistrates are also empowered to make

regulations for the proper sanitary condition of such buildings, and to determine in each licence the number of cattle which may be kept in each building.

SEC. 4.—In the case of burghs (other than royal and parliamentary burghs) and populous places which have adopted the whole or portions of the Police and Improvement (Scotland) Act, 1862, or previously to the passing of that Act had adopted the whole or any parts of the Police of Towns (Scotland) Act, 1850, the commissioners under those Acts shall have similar powers to those specified in Sec. 3 as to licensing, &c., of cattle sheds, cow-houses and byres.

SEC. 5.—The magistrates before whom any person is convicted of non-observance of any regulations made under this Act may require the owner or occupier of a cattle shed, cow-house or byre to make such sanitary improvements as they shall direct within a period of one month, and in case of non-compliance may suspend for a period not exceeding one month the licence granted to such person under this Act. Upon conviction for a second or subsequent like offence the licence may be revoked, and in such a case the magistrates or commissioners may refuse to grant any licence whatsoever to the person concerned.

SEC. 6.—Licences must be renewed annually, and the use of a cattle shed, &c., without a licence shall render the offender liable for each offence to a penalty not exceeding £5.

Note.—SEC. 31 (3) of the Milk and Dairies (Scotland) Act, 1914, provides that the cattle sheds in Burghs (Scotland) Act, 1866, shall not apply to any premises which are required to be registered in terms of the 1914 Act.

Milk and Dairies (Scotland) Act, 1914

The more important provisions of the Act are summarized below:

The term " dairy " includes any creamery, farm, farmhouse, byre, cowshed, milk store, milk shop, or other premises from which milk is sold or supplied for sale, or in which it is kept for purposes of sale, or which are used for the making of butter, cheese, or other milk products for human consumption for purposes of sale, but does not include premises from which a person sells milk only in small quantities, and for their own consumption, to persons in his employment or to neighbours.

The word " milk " includes cream, skimmed milk, separated milk, and buttermilk. The L.A.s are the councils of counties and large burghs.

SEC. 3.—V.I.s may, and when required by the D. of H. (Scotland) shall, be appointed by L.A.s. L.A.s may make arrangements for the bacteriological and other examination of specimens and samples taken for the purposes of the Act.

SECS. 4–6.—Every dairy in the district must be inspected at least once a year by the M.O.H., S.I., or other authorized officer, and the cattle in every dairy by the V.I. The L.A. may also authorize the inspection of cattle in premises from which milk is sold only in small quantities to and for the consumption of employees or neighbours. If the M.O.H. or S.I. is of opinion that any milk consigned to their district from any other district is impure or likely to cause disease, the M.O.H., S.I. or V.I. may inspect the dairy from which the milk was consigned, and examine the cattle therein. Notice of intention to inspect must be given to the M.O.H. of the outside district.

SEC. 7.—Every dairyman must have a certificate of registration from the L.A. in respect of the premises in which he carries on trade. The L.A. may refuse to grant a certificate or revoke a certificate, if the person is or becomes unsuitable to carry on the trade of a dairyman, or the premises are, or become unsuitable. There is appeal to the Sheriff whose decision is final. When a person sells from a cart, van, or other vehicle within a district milk supplied from outside the

district, the cart, van on vehicle must be registered. The L.A. must keep a register of dairies and dairymen.

Sec. 8.—Bye-laws must be made by a L.A. for the inspection of cattle in dairies, the construction of dairy premises, securing the purity of milk and the cleanliness and health of the cows, the cleanliness of person and clothing of those engaged in the business, and of all utensils and vehicles used for the storage or conveyance of milk, and for precautions to be taken by dairymen against infection or contamination.

Sec. 12.—The Department of Health, with the concurrence of the Department of Agriculture for Scotland, may make general or special orders for a number of specified purposes. (The Milk and Dairies (Scotland) Order, 1925, was made under this Act.)

Sec. 13.—It is an offence knowingly to consign, sell, offer, or expose or keep for sale for human food the milk of a cow suffering from tuberculosis with emaciation, or tuberculosis of the udder, or giving tuberculous milk, or having any sore on the teats with suppuration or bleeding or any disease liable to infect the milk.

Sec. 14.—Any dairyman who has in his dairy any such diseased cow must forthwith notify the L.A.

Sec. 15.—The dairyman must forthwith notify the M.O.H. if any person resident at or employed in a dairy or residing in the same house as any person so employed show symptoms of any infectious disease.

Sec. 16.—If milk from the dairy in question is consigned to an outside district the M.O.H. must communicate the facts to the M.O.H. of the outside district.

Sec. 17.—No person suffering from or showing symptoms of any infectious disease or suffering from any suppurating sore or sore throat or diarrhœa, may milk cows or handle milk vessels, unless under a medical certificate to the effect that he can do so without risk of spreading disease, and no person who has recently been in contact with a person suffering from infectious disease, or who resides in a house where any infectious disease exists, may assist in the conduct of the trade or business of a dairyman without proper precautions being taken.

Sec. 18.—If the M.O.H. has evidence that any person in his district is suffering from infectious disease or illness attributable to milk from any dairy in his district or that the milk from any such dairy is likely to cause such infectious disease or illness, he, after examination of the dairy and the employees or residents there, shall submit a report to the L.A., together with the report of the V.I. if it has been found necessary to have the cattle examined. The L.A. shall meet forthwith and may make an order stopping the supply of milk, or resolve that no order is necessary. If the milk is being supplied from another district, the M.O.H. of that district must be notified and must examine and report forthwith to his L.A. who may make a similar order. Due notice of the meeting of a L.A., with a copy of all the reports on the case, must be given to the dairyman, who is entitled to appear at the meeting. A copy of any order made must be transmitted to the L.A. of every district to which the milk is supplied from the dairy in question. Pending the decision of the L.A. in regard to the making of the order, the M.O.H. may make an interim order stopping the supply. The order made by the L.A. remains in force until withdrawn on the L.A. or the M.O.H., on their behalf, being satisfied that the milk is no longer likely to cause infectious disease. Any L.A. or dairyman aggrieved by any such order or resolution, or withdrawal of order or failure to make an order may appeal to the Sheriff of the district in which the dairy is situated. If a dairyman sustains damage by reason of an order, and the damage was not due to his own default, the L.A. or L.A.s concerned are liable to pay full compensation.

Sec. 19.—If the M.O.H. certifies to the L.A. that in his opinion the outbreak or spread of infectious disease in his district is attributable to milk supplied by

any dairyman (whether wholesale or retail) or that infectious disease is likely to be so spread, or that any milk is contaminated or impure, the L.A. may require the dairyman, whether within or without their district, to furnish a complete list of the names and addresses of his customers and of the parties from whom during a specified period he obtained supplies of milk.

SEC. 20.—The L.A. and any officers appointed by them may enter and inspect dairies in the district. The M.O.H. may examine persons employed or resident at the dairy and require such persons to provide him with specimens of mucus, urine, or fæces for bacteriological examination. The V.I. has power to examine the cattle of the dairy.

SEC. 21.—The M.O.H., S.I., or V.I. of a district may, and if required by the M.O.H. of an outside district to which milk is consigned, must, take samples of milk for examination. The M.O.H., S.I. or V.I. may require any cow to be milked in his presence and may take samples from particular teats and also samples of fæces and urine or any abnormal discharge from any cow.

SEC. 22.—A V.I. may apply the tuberculin test to any cow with the previous consent in writing of the owner.

SEC. 28.—Subject to the consent of the D. of H. (Scotland) a L.A. may establish and maintain depots for the sale of milk for infants under two years of age.

SEC. 29.—Where premises which, with the expressed or implied consent of the landlord or his agent, are used by the tenant as a dairy and cannot, by reason of the Act or any bye-law or regulation made thereunder, continue to be so used unless altered or improved, the tenant may make the necessary alterations and recover from the landlord an equitable proportion of the expenses incurred. The tenant must, however, give notice to the landlord of his intention to make such alterations and shall not proceed with the execution of the works if the landlord within 28 days after receipt of the notice undertakes to execute the necessary alterations, subject to recovery from the tenant of such proportion of the expense as may be equitable under the circumstances of the case.

Any question as to the reasonable necessity of any alteration or improvement or as to the proportion of the expenses to be paid by the landlord and tenant respectively shall, in default of agreement, be determined by arbitration.

Milk and Dairies (Scotland) Order, 1925

The Order applies only to milk intended for sale for human consumption or for the making of milk products for human consumption or for use as an ingredient in an article of food for human consumption.

No person may transfer milk from one vessel to another vessel except in registered premises. Provided, however, that if due precautions to prevent contamination are taken, this prohibition shall not apply where milk is being sold by retail or so as to prevent a dairyman (while on his rounds selling milk by retail from a vehicle) transferring milk on the vehicle from one vessel to another vessel thereon.

No dairyman shall keep or store milk or any milk vessel in a cowshed, kitchen, dwelling room, sleeping apartment, or in a place used for washing, drying, ironing or mangling clothes, or for any purpose likely to cause contamination of the milk or milk vessel, or in any place so situated as to be exposed to effluvia from a pigsty, dungstead, manure heap, cesspool privies, ashpit or refuse heap or in any place where the milk or milk vessel is liable to be infected or contaminated by impure air.

No milk vessel must be used for any purpose likely to cause contamination of the milk, and any appliance used for the washing or scalding of milk vessels must not be used for any purpose likely to cause contamination of the milk.

The conveyance in any milk vehicle of any article likely to contaminate milk is prohibited.

All vessels containing milk must be properly covered, or otherwise effectively protected so as to prevent contamination of the milk.

Every person in or about a dairy having access to the milk or milk receptacles on becoming aware that a member of his household is suffering from an infectious disease must immediately notify the dairyman.

It is an offence to add any colouring or thickening matter to cream or to sell cream so treated.

A dairyman must not use any vessel belonging to any other owner for the collection or delivery of milk to any person other than the owner, except with the consent of the owner.

No wooden vessel may be used for the conveyance of milk other than buttermilk; no milk may be consigned for transit in a vessel (other than a bottle) unless the vessel is permanently marked with the name and address of the owner and provided with a lid without openings.

Before delivery to a common carrier or other person for transit, a vessel containing milk must be sealed by means of a lead seal or be locked. This provision does not apply to properly closed or capped bottles.

No person may sell by retail skimmed or separated milk, or cream from a vessel unless the vessel is labelled or clearly marked " skimmed milk ", " separated milk ", or " cream ".

Great Britain

Milk and Dairies (Amendment) Act, 1922

The more important provisions of this Act, which applies to Scotland as well as to England and Wales, are as follows:

Power to refuse Registration of, or remove from Register, Retailers of Milk

Sec. 2 empowers the S.A. to refuse registration of any retail purveyor of milk, or to remove him from the register, if they are satisfied that the public health is, or is likely to be, endangered by an act or default of his in relation to quality, storage, or distribution of milk. There is an appeal to courts of summary jurisdiction and quarter sessions against the S.A.'s decision.

The Court before whom a registered purveyor of milk is convicted of any offence under any enactment relating to milk and dairies or any order or regulation made thereunder may, on the application of the L.A., in addition to any other penalty, be removed from the register either absolutely or in respect of specified premises for such period as the Court may think fit.

Licences to sell Milk under Special Designations

Sec. 3 authorizes the M. of H. (and the D. of H. (Scotland)) to grant licences for the sale of milk under special designations, and provides that except under and in accordance with such a licence or a licence granted with his authority under the provisions of an order made under the Act, a person shall not, on or in connexion with any sale or offer for sale or proposed sale of any milk, or in any advertisement, circular or notice relating to any milk, describe or refer to the same as " Certified ", " Grade A ", " Pasteurized ", or by any other prescribed designa-

tion, or use any description or designation including or resembling any prescribed designation. (See p. 355.)

PROHIBITION OF ADDITION OF COLOURING MATTER, ETC., TO MILK

SEC. 4.—Reference is made to this section on p. 471.

PROHIBITION OF SALE OF TUBERCULOUS MILK

SEC. 5.—No person shall sell or offer or expose for sale the milk of a cow suffering from tuberculosis of the udder, and he shall be guilty of an offence under this section if it is proved that he knew, or could by the exercise of ordinary care have ascertained, that the cow was suffering from that disease. For a first offence the penalty is a fine not exceeding £20, and for a second or subsequent offence a fine not exceeding £100, or imprisonment, with or without hard labour, for a period of six months, or both such fine and imprisonment.[1]

Tuberculosis Order, 1925, as amended by Tuberculosis (Amendment) Order, 1931

This Order made by the M. of A. and F. applies to England, Wales and Scotland. It provides for the notification and slaughter of bovine animals affected with certain specified forms of tuberculosis, with compensation to the owner. It is administered by the L.A.s under the Diseases of Animals Acts. The provisions of the Order are intended to be complementary to the provisions of the Milk and Dairies Acts prohibiting the sale of tuberculous milk. Thus it is the duty of a L.A. when, in the exercise of their powers under those Acts, they discover the presence in a herd of an animal to which the Order applies, to cause it to be slaughtered in pursuance of the Order, or if they are not themselves the authority for the purposes of the Diseases of Animals Acts, to report the matter to that authority for appropriate action. The following are the more important provisions of the Order:

Every person having in his possession any of the following must forthwith notify the fact to a police constable or to an I. of the L.A.:

(*a*) Any cow which is, or appears to be, suffering from tuberculosis of the udder, indurated udder, or other chronic disease of the udder.
(*b*) Any bovine animal which is, or appears to be, suffering from tuberculous emaciation.
(*c*) Any bovine animal suffering from a chronic cough, and showing definite clinical signs of tuberculosis.

A V.S. finding any such animal in his private practice must forthwith notify an I. of the L.A. The L.A. must forthwith direct a V.I. to examine the animal and any other bovine animal on the premises which the I. considers it desirable to examine. The I. may apply the tuberculin test, if he obtains the consent of the owner in writing. He may require the cow to be milked in his presence, and may take samples from a particular teat. He may also take samples of urine or fæces or of any abnormal discharge.

If the report of the V.I. shows that any animal is suffering from the conditions specified in (*a*), (*b*) or (*c*) above, or that any cow is giving tuberculous milk,

[1] It may be observed that Sec. 5 of this Act and Sec. 5 of the Milk and Dairies (Consolidated) Act, 1915, both prohibit the sale of milk from a cow suffering from tuberculosis of the udder. The latter section is, however, wider in its application, while that in the 1922 Act provides a heavier penalty. See also Sec. 13 of the Milk and Dairies (Scotland) Act, 1914.

the L.A. shall forthwith notify the owner and the M. of A. and F., and shall cause the animal to be slaughtered. If the owner objects to slaughter, or if the value of the animal as agreed under the Order exceeds £50, the L.A. may not proceed with the slaughter without the authority of the Minister. In such a case the I. must serve a notice forbidding the removal of the animal without licence.

The market value of the animal must be determined before slaughter by agreement between the L.A. and the owner, or failing agreement, by a valuer appointed by the L.A. and the owner, or on application by the L.A. appointed by the Minister. The basis of valuation shall be the price which might reasonably have been obtained in the open market from a purchaser after inspection of the animal, without knowledge of the symptoms of disease disclosed by the I.'s report.

A post-mortem examination of the slaughtered animal—at which the owner or his representative may be present—must be made as soon as practicable by a V.S. of the L.A.

Compensation, based on the V.I.'s report, is payable to the owner as follows:

(*a*) No tuberculosis, market value plus £1.
(*b*) Tuberculosis (not advanced), three-quarters market value or 30 shillings, whichever sum is greater, after deducting from such sum one-half of the reasonable costs of any valuer appointed by the Minister.
(*c*) Advanced tuberculosis, one-quarter market value or 30 shillings, whichever may be greater, minus half costs as above.

If no post-mortem examination was made, compensation is payable as in (*a*) above.

If in any case the sum received by the L.A. on sale of a carcass of an animal slaughtered under this Order exceeds the amount paid for compensation to the owner of the animal, the L.A. shall pay the excess to the owner, after deducting reasonable expenses.

Advanced tuberculosis for purposes of the Order means:

(*a*) Miliary tuberculosis of both lungs.
(*b*) Tuberculous lesions on the pleura and peritoneum.
(*c*) Tuberculous lesions in the muscular system, or in the lymphatic glands in or between the muscles, or where the infection of the glands is sufficient to indicate widespread disease.
(*d*) Where, in addition to tuberculous lesions in the respiratory and digestive tracts, there are also lesions in the substance or membranes of any two of the following: spleen, kidney, uterus, ovary, testicle, brain and spinal cord.

The milk produced by a cow suffering from chronic disease of the udder, or tuberculous emaciation, or from chronic cough with definite clinical signs of tuberculosis must not be mixed with other milk until the cow has been examined by a V.S., and until after the six weeks required for microscopical and biological tests have expired, or the cow has been declared free. The milk of such a cow and of a cow under notice of slaughter must forthwith be boiled or otherwise sterilized, and any utensil in which such milk is placed before being so treated shall be thoroughly cleansed with boiling water before any other milk is placed therein.

All suspected animals must be isolated from other bovine animals, and when a suspected animal is found in a market fair-ground or sale-yard the V.I. may require it to be removed to the premises whence it came or at the option of the owner to a slaughter-house.

An I. of a L.A. may require the occupier of premises where there has been an infected animal to cleanse and disinfect at his own expense any part of any shed or other erection in which the animal has recently been kept.

L.A.s receive from the Exchequer 75 per cent of the amount of compensation paid for animals slaughtered under this Order.

Tuberculosis Order, 1925 (No. 2)

The Order provides that, where the carcass of an animal, slaughtered under the provisions of the Tuberculosis Order, 1925 (No. 1), is intended to be used for human consumption a copy of the notice sent to the owner shall also be sent to the S.A. and the carcass must not be removed from the premises for human consumption without the written consent of the M.O.H. or other competent officer of the S.A.

CHAPTER VI

Fish and Shellfish

ENGLAND AND WALES: Salmon and Freshwater Fisheries Act, 1923[1]—Salmon and Freshwater Fisheries (Amendment) Act, 1929—Sea Fisheries (Shellfish) Regulations Act, 1894—Public Health (Shellfish) Regulations, 1915.

GREAT BRITAIN: Merchandise Marks (Imported Goods) No. 8 Order, 1931—Sea Fishing Industry Act, 1933—Fisheries (Oysters, Crabs and Lobsters) Act, 1877—Public Health (Cleansing of Shellfish) Act, 1932.

England and Wales

Salmon and Freshwater Fisheries Act, 1923

Under this Act the main provisions dealing with the sale of fish are the following:

SEC. 2.—It is illegal for the purpose of fishing for salmon, trout, or freshwater fish, for any person to buy, sell or expose for sale or have in his possession any roe of salmon or trout.

SEC. 3.—It is illegal for any person to buy, sell or expose for sale, or have in his possession any salmon, trout, or freshwater fish which is " unclean " or " immature " within the meaning of this Act, or any part of such fish.

SEC. 26.—The close season for salmon is defined under (3); the annual close season (except for rod and line) shall be in any place the period which has been fixed in that behalf by a bye-law under this or any other Act, or, if there is no such bye-law, the period between the 31st day of August and the 1st day of February following.

SEC. 30 prohibits the buying, selling, or exposing for sale or possession of any salmon or part of any salmon between 31st August and 1st February.

Exceptions are made in respect of:

(*a*) Salmon preserved outside Great Britain and Ireland.
(*b*) Salmon preserved within Great Britain or Ireland between 1st February and 31st August.
(*c*) Fresh salmon caught outside Great Britain and Ireland and not unclean.
(*d*) Fresh salmon caught (not being unclean or immature) within Great Britain and Ireland by some method other than by rod and line, if its capture was lawful at the time and place of capture.

The burden of proving that salmon bought, sold, exposed for sale, or in possession for sale between 31st August and 1st February is not bought, &c., in contravention of Sec. 30 lies on the person buying, selling, &c.

[1] Certain sections of this Act (to which reference is not made in the text) apply to the Rivers Tweed and Esk and the Solway Firth.

SEC. 31.—The close season for trout (except for rod and line) (other than date fixed by local bye-laws) is defined as the period between the 31st day of August and the 1st day of March following (rainbow trout excepted).

SEC. 32.—Buying, selling, or exposing or purchasing for sale any trout between the 31st day of August and the 1st day of March following is illegal.

SEC. 33.—Unclean salmon or trout must not be exported or entered for exportation nor must salmon, caught during the period between 31st August and 1st February, or trout (other than rainbow trout), caught between 31st August and 1st March, be exported or entered for export unless capture by instrument other than rod and line was legal at the time the fish was caught.

The burden of proving that any salmon or trout entered for exportation between the 31st day of August and the 1st day of May following is not so entered in contravention of the preceding subsection shall lie on the person entering the same for exportation.

All salmon or trout intended for exportation between the 31st day of August and the 1st day of May following, shall be entered for that purpose with the proper Officer of Customs and Excise at the port or place of intended exportation, before shipment thereof.

If any salmon or trout is entered for exportation or exported, or brought to any wharf, quay or other place for exportation, contrary to this section or is not entered as required by this section, the salmon or trout and any package containing the salmon or trout shall be deemed to be goods forfeited under the enactments relating to customs and the persons entering or exporting the salmon or trout, or bringing the salmon or trout for exportation, or failing to enter the salmon or trout as required by this section, shall be guilty of an offence against this Act.

Any Officer of Customs and Excise may, between the 31st day of August and the 1st day of May following, open or cause to be opened any parcel entered or intended for exportation, or brought to any quay, wharf or other place for that purpose, and suspected by him to contain salmon or trout, and may detain or cause to be detained any salmon or trout found in the parcel until proof is given of the salmon or trout being such as may be legally exported; and if the salmon or trout, before such proof is given, becomes unfit for human food, the Officer may destroy the same or cause the same to be destroyed.

SEC. 34.—No person shall consign or send by any common or other carrier any salmon or trout unless the package containing the salmon or trout is conspicuously marked on the outside thereof with the word salmon or trout as the case may be.

Any of the following Officers, that is to say:

(*a*) any Officer of a Fishery Board acting within the Fishery District;

(*b*) any Officer of a Market Authority acting within the area of the jurisdiction of that Authority;

(*c*) any Officer appointed for the purpose by the Minister;

(*d*) any Officer appointed in writing by the Fishmongers Company;

(*e*) any Officer of Police,

may open any package so consigned or sent, or brought to any place to be so consigned or sent, and suspected to contain salmon or trout, and if any such package is found to contain salmon or trout, and is not marked in accordance with this section, or if there is reasonable cause to suspect that the salmon or trout contained in any marked package is being dealt with contrary to law, may detain such package and the contents thereof until proof is given that the salmon or trout is not being so dealt with, and in like manner and under like conditions may detain any such salmon or trout not packed in any package, and if before such proof is given any salmon or trout detained under the provisions of this section becomes unfit for human food, may destroy the same or cause the same to be destroyed.

If any person contravenes this section or refuses to allow any person acting under the authority thereof to exercise the powers conferred thereby or obstructs any such person in the exercise of those powers, he shall be guilty of an offence against this Act.

For the purposes of this section:

The expression "Market Authority" includes any corporation, local authority, body of trustees, or other persons having power to maintain or regulate any market.

The expression "Fishmongers Company" means the wardens and commonalty of the "Mystery of Fishmongers in the City of London".

The expression "salmon" includes a part of a salmon, and the expression "trout" includes a part of a trout.

SEC. 35 (2).—The close season for freshwater fish shall be the period between the 14th March and the 16th June (unless local bye-laws have substituted a different period).

For the definition of "freshwater fish" see below, but it should be noted that certain fishing districts (or parts thereof) are exempted from the above season for freshwater fish, and also certain districts have special definitions for these fish.

SEC. 35 (3).—Buying, selling, or exposing for sale or having in possession for sale any freshwater fish (other than fish preserved for use as bait or stocking a fishery) between 14th March and 16th June is illegal.

Under the Act, Fishery Districts and Fishery Boards are defined, with their powers, provisions, and proceedings. They are granted powers to make bye-laws and to issue licences. Powers are also set out for Water Bailiffs and others. The penalties for offence against the Act are heavy, and for a first offence any person found guilty is liable to a fine not exceeding £50, and to forfeiture of fish illegally taken or in his possession at the time of the offence. Proceedings against any person contravening any of the provisions of the Act may be instituted before a court of summary jurisdiction in any place where the fish in respect whereof the proceedings are taken or the person charged may be found.

SEC. 78.—Any of the following officers may seize any salmon, trout or freshwater fish bought, sold, or exposed for sale, by or in the possession for sale, of any person in contravention of this Act.

Any Officer of a Fishery Board acting within the Fishery District.

Any Officer of a Market Authority acting within the area of the jurisdiction of that Authority.

Any Officer appointed for the purpose by the M. of A. and F.

Any Officer appointed in writing by the Fishmonger's Company in that behalf, and

Any Officer of the Police.

Definitions:

"Salmon"—all fish of the salmon species.

"Trout"—any fish of the salmon family commonly known as trout, including "migratory trout" which migrate to and from the sea.

"Freshwater fish"—any fish living in fresh water exclusive of salmon and trout, and of any kinds of fish which migrate to and from tidal waters and of eels and the fry of eels.

"Immature", in relation to salmon, means a length of less than 12 inches measured from the tip of the snout to the fork or cleft of the tail. In relation to any other fish means that the fish is of a length less than that prescribed by bye-laws applicable to the water in which the fish was taken.

"Unclean" in relation to any fish means that the fish is about to spawn, or has recently spawned and has not recovered from spawning.

Salmon and Freshwater Fisheries (Amendment) Act, 1929

This Act makes provision for the sale of trout during the close season under special circumstances as for salmon under Sec. 30 of the Act of 1923.

Sea Fisheries (Shellfish) Regulation Act, 1894

Under this Act the powers of Local Fisheries Committees are extended with respect to shellfish fisheries enabling them to make bye-laws within their district for the regulation, protection, and development of all or any specified kind of shellfish and to incur such expenses as may be sanctioned by the M. of A. and F. for restocking any public fishery for shellfish.

The Public Health (Shellfish) Regulations, 1915

The Regulations grant powers to the L.A. to deal with shellfish layings if there is evidence to show that the shellfish derived from them have actually caused infectious or other disease, or are likely to be a source of danger to public health. If cases of infectious or other disease attributable to shellfish occur in the district, or if the M.O.H. has reason to believe that the consumption of shellfish exposed for sale within the district is likely to cause danger to public health, he shall take steps to discover the laying or layings from which the shellfish were derived and shall report thereon to the L.A. Fishmongers may be required to make returns to the M.O.H. of all layings from which shellfish have been obtained during the six weeks prior to the date of notice. If the layings are public and within the district of the L.A., they may give notice to interested persons to appear before them and show cause why an Order should not be made prohibiting the sale of shellfish till they have been relaid for such period as the L.A., on the advice of their M.O.H., may direct. If the layings are outside the district, the L.A. must make a representation to the L.A. in whose district the layings are situated, and with a view to similar action being taken. If the L.A. concerned fails to take such action, appeal may be made to the Ministry of Health. (It should be noted that, if the shellfish layings are situated within a Port Sanitary District, representation should be made to the P.S.A.) In the case of private layings, an Order may be made against the owner or occupier if he is not prepared to deal with the shellfish as required by the L.A. All action taken under the Regulations must be reported by L.A.s to the M. of H. and M. of A. and F. After an Order is made, the L.A. shall cause a copy of the Order to be served on all interested persons, shall publish the Order in one or more local newspapers, and shall cause warning notices to be posted in conspicuous places. Interested persons may, within fourteen days of the date on which the Order was served on them, appeal to the Ministry of Health against an Order made by a L.A. Penalties are imposed for selling, exposing, distributing, or offering to sell, or possessing for the purpose of sale, shellfish from any laying in respect of which an Order has been made. Before taking proceedings the L.A. must give the individual liable an opportunity to submit an explanation.

The Public Health (Shellfish) Regulations, 1934

Regulations amending and revoking the 1915 Regulations have been issued in draft form and are expected to come into operation at an early date.

The more important changes contemplated are that the L.A. cannot require

interested persons to appear before them and show cause why an Order should not be made. Such persons are, however, to be given a reasonable opportunity of making representation, and the L.A. will be required to supply a copy of the report of the M.O.H. to any person interested on payment of a reasonable sum.

The L.A. will be given power to prescribe in the Order the conditions of cleansing and to vary Orders where circumstances require it.

Great Britain

The Merchandise Marks (Imported Goods) No. 8 Order, 1931

Under this Order:

It shall not be lawful to sell or expose for sale in the United Kingdom any imported frozen or chilled salmon or imported frozen or chilled sea-trout, or any imported salmon or sea-trout which had been subjected to any process of freezing or chilling prior to importation, unless it bears an indication of origin. " Salmon " means all fish of the species *Salmo salar* and of the genus *Oncorhynchus*;

" Sea-trout " includes sea-trout and salmon trout and all fish sold or exposed for sale or offered for sale as trout, sea-trout, or salmon trout.

Meaning of " Indication of Origin ": Under Sec. 10 of the Merchandise Marks Act, 1926, the person applying the indication may as he chooses either mark it (*a*) by the use of the word " Foreign " or " Empire " according to whether it was produced in a foreign country or in a part of His Majesty's Dominions outside the United Kingdom, or (*b*) by a definite indication of the country in which the goods were produced.

Method of applying " Indication of Origin ": (*a*) On exposure for sale wholesale and on sale; by means of a printed or stamped paper or parchment label attached or applied to each fish, bearing the indication of origin in legible and conspicuous lettering; (*b*) On exposure for sale by retail by means of a label or show ticket placed on, or in close proximity to, the fish or portion of fish to which it relates so as to be clearly visible to intending purchasers, bearing the indication of origin in letters not less than half an inch in height.

Portions of fish need not be marked when handed over to the purchaser, but must be marked on exposure for sale in the same manner as whole fish.

The penalty for a first offence is a fine not exceeding £5, and for a second or subsequent offence a fine not exceeding £20, and, save in the case of a first offence, forfeiture of the goods may also result.

Sea-fishing Industry Act, 1933

The Sea-fishing Industry (Immature Sea-fish) Order, dated the 29th day of July, 1933, and 11th day of April, 1934, made by the Minister of Agriculture and Fisheries and the Secretary of State for Scotland.

1. No person shall in Great Britain sell, expose or offer for sale, or have in his possession for the purpose of sale, any sea-fish of the following kinds of less than the following measurement, that is to say:

Hake, thirteen inches long.
Haddock, nine and a half inches long.
Whiting, nine and a half inches long.
Plaice, nine inches long.

Dabs, nine inches long.
Soles, nine inches long.
Lemon Soles, nine inches long.
Witches, nine inches long.
Megrims, nine inches long.

The measurement being taken in each case in a straight line from the tip of the snout to the farthest extremity of the tail when the fish is laid flat.

Fisheries (Oysters, Crabs and Lobsters) Act, 1877

Under Sec. 4 of the above Act and the M. of A. and F. Acts, 1889 to 1919, the sale, exposure or consignment for sale, or purchase of deep-sea oysters between the 15th day of June and the 4th day of August, and the sale, exposure or consignment for sale, or purchase of any other oysters between the 14th day of May and the 4th day of August is prohibited, unless the oysters were taken within the waters of some foreign state or were preserved in tins or otherwise cured or were intended for oyster cultivation within the same district in which they were taken, or were taken from any place for cultivation with the sanction of the M. of A. and F.

Under the Act it is illegal to take, have in possession, sell, expose for sale, consign for sale or buy for sale:

(*a*) Any edible crab which measures less than 4½ inches across the broadest part of the back;
(*b*) Any edible crab carrying spawn attached to the tail or other exterior part of the crab, whether known as " berried ", " seed ", " spawn " or " ran " crab, or by any other name;
(*c*) Any edible crab which has recently cast its shell, whether known as " caster ", " white crab ", " white-footed crab ", " white-livered crab ", " soft crab ", " glass crab ", or by any other name;
(*d*) Any lobster which measures less than 8 inches from the tip of the beak to the end of the tail, when spread as far as possible flat.

The penalty for a first offence is a fine of £2, and £10 for every subsequent offence, and in either case forfeiture of the crabs or lobsters.

The local fisheries committees for certain sea fisheries districts in E. and W. have made bye-laws revising the size limits for crabs and lobsters beyond those imposed by the Act, defining close seasons and protecting buried lobsters.

The Public Health (Cleansing of Shellfish) Act, 1932

This Act empowers C.C.s and L.A.s to provide tanks or other apparatus for the cleansing of shellfish, or to contribute toward the expense of providing such tanks, &c. They are also empowered to make reasonable charges for the use of the tanks and apparatus. The Act with suitable modifications applies to Scotland.

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